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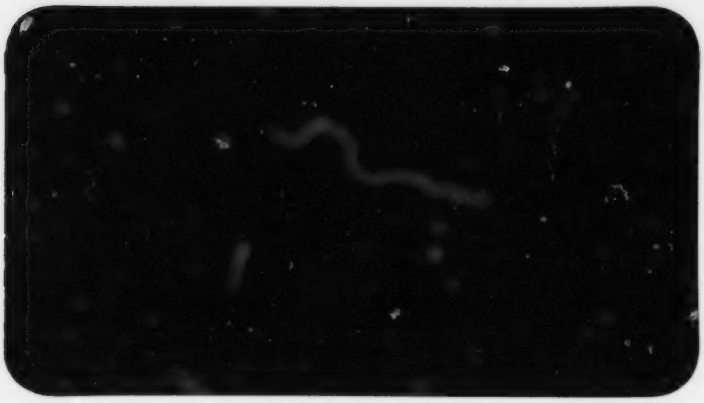
MANITOBA HAZARDOUS WASTE MANAGEMENT CORPORATION

91-03923/

Corporate Profile The Manitoba Hazardous Waste Management Corporation is a commercial Crown corporation established to develop and operate a hazardous waste management system for Manitoba. Its mandate is to provide for the handling of regulated hazardous wastes from their source through to their treatment and disposal, consistent with high standards of public health, safety and environmental quality.



Environmental Policy Statement

The Manitoba Hazardous Waste Management Corporation is committed to the preservation and enhancement of environmental quality through the development of a hazardous waste management system for the province. This undertaking is a fundamental element needed to achieve the broader objectives of universal environmental stewardship and sustainable economic development within Manitoba.

To reach these goals, the Corporation uses the following policy objectives as the basis for the performance of its work.

- Minimize waste generation and maximize resource conservation through the promotion and facilitation of waste reduction, recycling, re-use and recovery at source.
- Ensure that all activities involved with the handling, storage, treatment and disposal of waste and residue products are consistent with the protection of public health and environmental quality.
- Earn public approval of the system and its components through open and responsive communication and through public participation in all aspects of their development and operation.
- Encourage economic development through the provision of a cost-effective waste management system and the enhancement of environmentally based enterprises.
- Foster and promote contemporary environmental values and policies through public education and research, as well as by example.
- Assume, in perpetuity, the environmental stewardship of wastes and residues placed in the Corporation's custody.

Information regarding the activities and programs of the
Manitoba Hazardous Waste Management Corporation can be obtained from:
226-530 Century Street, Winnipeg, Manitoba R3H 0Y4
Telephone: (204) 945-1844 Toll Free: 1-800-782-2474 In Manitoba

HAZARDOUS WASTE MARKET CHARACTERIZATION STUDY FOR MANITOBA

Prepared by:

Manitoba Hazardous Waste
Management Corporation

November, 1989

EXECUTIVE SUMMARY

The Manitoba Hazardous Waste Management Corporation has prepared this report to provide a characterization of the hazardous waste market in Manitoba. The Work was undertaken with the assistance of Wardrop Engineering, in association with Energy Systems Research Group Inc. and the University of Manitoba Research Limited. This report presents the methodology and results of the survey performed by the Consultant, and the characterization and conclusions performed by the Corporation. The results have been used as input to facility development work.

Methodology

The survey methodology employed in the study involved the use of a hybrid targeted/stratified statistical sampling technique. The generators of Hazardous waste were separated into two distinct populations, the small number of major generators who produce the majority of waste, and the remaining large number of minor generators who produce a relatively small quantity of waste.

The major generators were selected for survey in the manner of a census, with as high a response rate as possible. A random sample of minor generators, stratified by Standard Industrial Classification (SIC), was selected to survey the remaining generators. A response rate of 30% was targeted for the minor generators. A questionnaire was sent to all sampled establishments to provide best estimates of their hazardous waste generation.

A computer database was established to contain the data, and to provide base-line extrapolations of the waste quantities. In addition, the "Wastes" computer modelling program was provided by ESRG as a tool for projecting waste generation into the future.

Results

Responses were ultimately received from 131 major generators and 317 minor generators, for response rates of 71% and 28% respectively.

The total quantity of waste reported was 178,290 tonnes/year. The reported data was evaluated and adjusted for the purpose of extrapolation and projection. Extrapolation of the adjusted data was then performed, to obtain the waste market characterization. The results indicate a total of 22,679 t/y expected to be available to a collective waste management system after companies reduce their waste at source through appropriate waste management processes. Of this quantity, 15,219 t/y is expected to be available to a central treatment facility, with the remainder collectively managed at other facilities both in Manitoba and out of province. This latter quantity will require the development of collection and transfer facilities.

Waste generators reported that the largest proportion of waste is presently being sewered. The remaining current disposal/management techniques, in order of preference are: landfilling, commercial haulage, storage, and recycling. The single most common waste was determined to be dilute cyanide/metals waste, produced by SIC 3400 (Fabricated Metals).

Conclusions

The waste market characterization has provided the Corporation with a comprehensive estimate of hazardous waste generated within Manitoba, and an assessment of those wastes which, after alternatives for management at source have been implemented, would ultimately require treatment at a central facility. The information has been used as input to the basic design component of facility development. In addition, the tools supplied by the work provide the capability to continuously update the information and provide projections of future waste estimates.

HAZARDOUS WASTE MARKET CHARACTERIZATION STUDY FOR THE PROVINCE OF MANITOBA

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1.0 INTRODUCTION

This report on the Hazardous Waste Market Characterization is an integral component of the Corporation's system development activities. The overall objective was to provide the Corporation with:

- a current data base of hazardous waste generation estimates for the province;
- capacity input to facility development work;
- a basis for the development of commercial strategies and a Corporate business plan; and
- management and analytical tools for the ongoing maintenance of a hazardous waste market data base.

The Manitoba Hazardous Waste Management Corporation engaged Wardrop Engineering Inc., in association with Energy Systems Research Group Inc. and the University of Manitoba Research Limited, to develop and implement a methodology for surveying the hazardous waste market for the province. The results were then analyzed for presentation as a current data base providing an assessment as to the quantity, type, distribution and availability of hazardous waste generated within Manitoba as well as management and analytical tools for the ongoing maintenance of the data base. The final result is a detailed characterization of the waste market in terms of its most appropriate disposition in an overall hazardous waste management system.

This report comprises two sections, Survey Development and Implementation, and Waste Market Characterization.

PART 1 - SURVEY DEVELOPMENT AND IMPLEMENTATION

2.0 LITERATURE REVIEW

Numerous jurisdictions in North America and Europe have undertaken studies in an attempt to estimate waste quantities and types, with many having performed several studies utilizing various methodologies in order to provide a more accurate and reliable assessment. A review of several studies done in North America was done in part by the Corporation and in part by the Consultant, with the following objectives:

- assess the applicability of different methodologies to Manitoba's situation;
- determine problems encountered;
- compare the consistency of various wastes and industry classification methods; and
- compare generation rates and/or factors obtained.

Table 1 below provides a methodology comparison done by the Corporation of recent studies undertaken in North America.

TABLE 1

Methodology Comparison of Five Jurisdictions

Jurisdiction	Generator Classification	Waste Class	Data Source
Alberta Reid Crowther (1980,87)[1,2]	U.S. SIC* Can. SIC	Unique	Generation Factors from Literature
Saskatchewan Dillon (1982)[3]	Can. SIC	TDG(UN)**	Questionnaire to 600 Establishments
Minnesota Weston (1983)[4]	U.S. SIC	UCD***	Generation factors from other Studies modified for State Conditions
Ontario Canviro (1985)[5]	U.S. SIC	UCD	Stratified Sample of 1000 (by SIC) Telephone/On-Site Interviews
Canada Proctor and Redfern (1984)(6)	U.S. and Can. SIC	UCD	Other Inventories

* U.S. and Canadian SIC or Standard Industrial Classification code. See section 3.4 and appendix C

** TDG The Canadian Transportation of Dangerous Goods Classification system, or UN system as described in this section.

*** UCD or University of California at Davis waste classification system. See section 3.3 and appendix A.

Table 2 provides a listing of 13 studies reviewed by Forrestal et. al. (1986)[6].

TABLE 2

Summary of Studies Reviewed by Forrestal et. al. (1986)

	Data Source		Study
1.	Waste Transfer Permit Data		MOE Waybill California McLaren Study CCPA Study
2.	Inventory of Selected Industries		New York Survey Canviro Kitchener Waterloo
3.	Waste Generation Survey Estimate		
	3.1	Jurisdiction Survey	Canviro 500 EPS Atlantic Region Illinois Survey
	3.2	Jurisdiction and Other Survey Data	OWMC Waste Quantities Study (Proctor and Redfern) Western and Northern Canada Study (Reid Crowther)
	3.3	Other Survey Data Only	Gore and Storrie Study Mitre Report

Reviews of the various studies identified three methodologies employed to characterize the waste generation market. These methodologies include:

- use of generator registration and/or waste manifest data;
- industry surveys, targeted and/or stratified random; and
- estimates employing generation factors, including:
  - jurisdiction survey (data from study area only)
  - jurisdiction survey plus generation factors from other areas
  - generation factors from other areas only.

The sub categories of the third methodology differentiated between those studies which derived generation factors from jurisdictional survey data and those which employed generation factors obtained from other studies. The studies which utilized waste generation factors from other jurisdictions employed them in two ways:

- as a check on the local data; and
- as the basis of extrapolation for the jurisdiction, usually with some verification checks in place.

- as the basis of extrapolation for the jurisdiction, usually with some verification checks in place.

The most reliable data available is derived from generator registration and manifest data; however, this is invariably incomplete as many generators have not registered and are currently disposing of their wastes in municipal sewers and landfills.

Standard Industrial Classifications (SIC), either Canadian or American, were used in all studies to categorize waste generators according to similarities in processes and product.

A wide range of classification systems are used for categorizing wastes, including Transportation of Dangerous Goods classification (UN system), the U.S. Resource Conservation and Recovery Act (RCRA) classification system, the University of California at Davis (UCD) system, as well as unique classification systems. The most common is the UCD system, which allows classification of wastes according to properties and treatment/disposal techniques. The Transportation of Dangerous Goods or UN classification system is used for waste shipping manifest purposes in Canada, but is not detailed enough for the purposes of this study. Table 3 lists these classes for information purposes.

TABLE 3

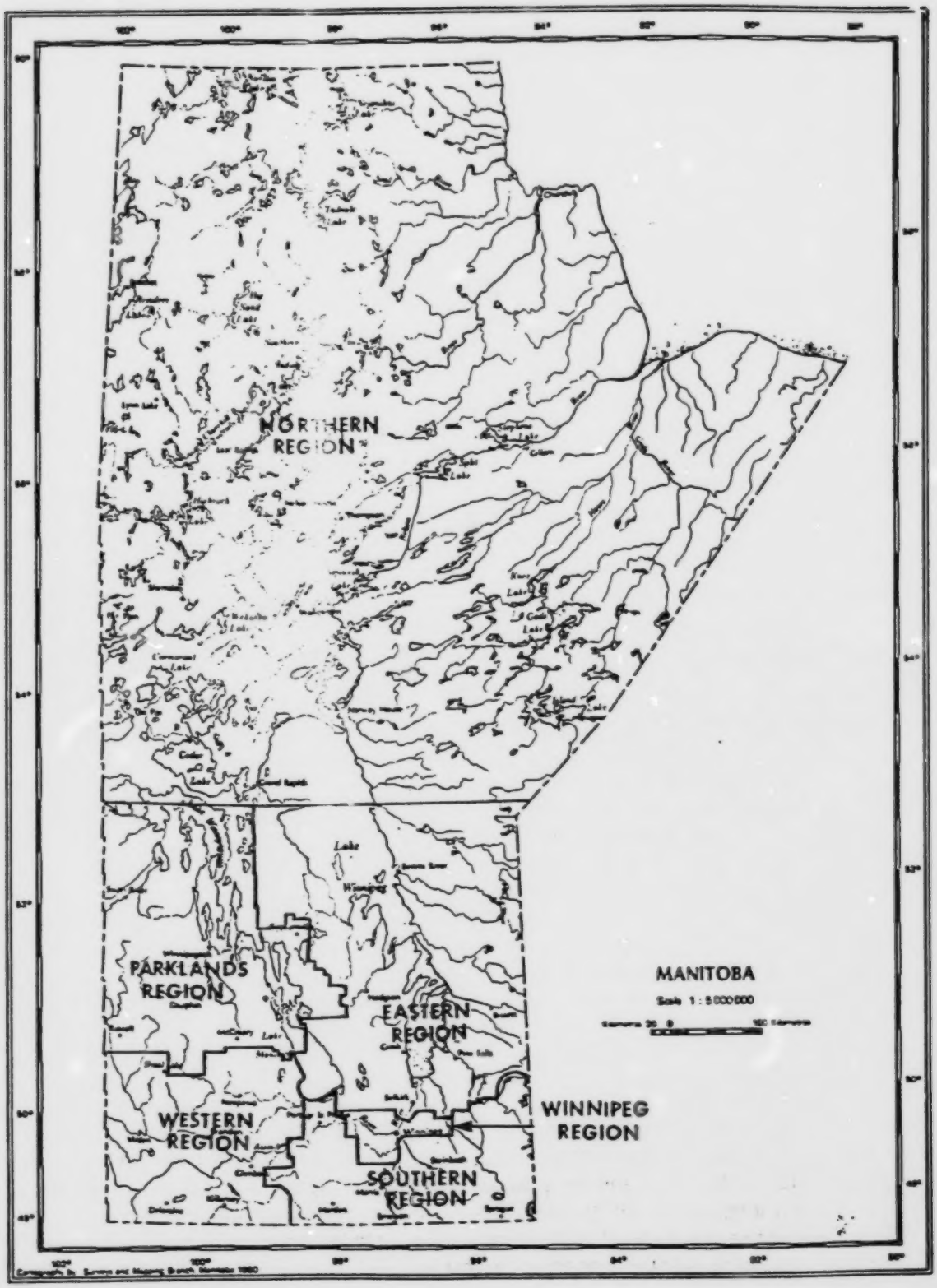
UN CLASS	NAME
1	Explosive
2	Compressed Gases
3	Flammable Liquids
4	Flammable Solids
5	Oxidizers
6	Poisonous (Toxic) and Infectious
7	Radioactive
8	Corrosive
9	Environmental Toxicity

In a study undertaken by Proctor and Redfern et. al. (1984), a comparative analysis of seven different waste classification systems identified the following four criteria as being essential for the selection of an appropriate classification system:

- compatibility with waste treatment technology;
- compatibility with other North American inventories;
- significant degree of disaggregation; and
- as few "miscellaneous" categories as possible.

The UCD system was chosen as closest to meeting the above criteria. A small proportion of wastes were classified in miscellaneous categories, and physical and chemical properties of a waste could be identified and compared for treatment and disposal purposes.

Figure 1 Hazardous waste regions



Several studies, most notably Forrestal et. al. (1986) and Canviro (1985), suggested that 90% of the total waste inventory could be determined from a targeted survey of a relatively small number of major generators. The minor quantities of wastes produced by the remaining large number of industries were characterized either by random survey, or waste generation factors obtained from other studies.

Some limitations noted during the review were:

- lack of comprehensive or standardized definition of hazardous waste in many jurisdictions;
- choice of SIC groupings and digit level (2 digit vs.3 or 4 digit) can introduce error to the extrapolation process;
- waste generator reports inaccurate, some waste destinations unknown; and
- business information sources used for extrapolation purposes contain inaccuracies. (misclassification, misidentification, missed companies.)

Two other studies which were of relevance to Manitoba were included in the review. The Wardrop Study (1979)[8] was reviewed by the Consultant for waste generation information specific to Manitoba, and as the basis for development of questionnaires. The most applicable previous study was completed by Yee et. al. (1985)[9] of the Manitoba Department of Environment, Workplace Safety and Health. The results of that report were used as a reference base for the present study, taking into account any limitations which were encountered. The most significant finding was that a relatively small number of generators contributed a significant proportion of waste reported.

3.0 DEFINITIONS AND CLASSIFICATIONS

In the development of the Corporation's methodology, it was necessary to define a number of parameters and to establish an appropriate method of classifying both waste types and generators. The classification methods chosen and their respective rationale are documented below.

3.1 Types of Wastes Surveyed

Hazardous wastes can in general be described as materials that are harmful to the environment, and in some cases, to human health, when disposed of in a random or uncontrolled manner. Hazardous wastes are now controlled by Provincial and Federal legislation, which regulate both transport and disposal of these materials.

In Manitoba, hazardous wastes are governed by the Manitoba Dangerous Goods Handling and Transportation Act and related regulations. These regulations provide a specific legislative definition of "hazardous wastes". According to Schedule 12 amendments of TDG, "Waste" means any product, substance or organism that is dangerous goods, that is no longer used for its original purpose and that is recyclable material or intended for treatment or disposal, including storage prior to treatment or disposal, but does not include a product, substance or organism that is:

- household in origin; or
- returned directly to a manufacturer or supplier of the product, substance or organism for reprocessing, repackaging or resale, including a product, substance or organism that is:
  - defective or otherwise not usable for the intended purpose, or
  - in surplus quantities but still usable for the intended purpose , or
  - included in class 1 (Explosive) or 7 (Radioactive).

All materials designated by the legislation fall under the mandate of the Corporation, and were the specific target of the survey. In addition, wastes which were not strictly defined as being hazardous under provincial regulation, but that may be subject to disposal restrictions by municipalities for environmental reasons, were included.

3.2 Wastes Excluded

Wastes specifically excluded were:

- radioactive materials, which are regulated federally;
- explosives, which are regulated federally;
- *military facility wastes; and
- *accidental spills or emergencies.

*Although these wastes were not included in the study, it is expected that these would likely be available to the provincial hazardous waste management system, once developed.

3.3 Waste Classification

The system chosen as best able to classify wastes was the University of California at Davis (UCD) Waste Classification System. The UCD system was developed in 1980 to classify wastes according to their properties, as well as to treatment and disposal categories. The system employs a three digit code which, like the SIC code for industry classification, provides a finer degree of segregation as more digits are used.

There are four major divisions, namely Inorganics, Organics, Sludges and Miscellaneous, with a total of 109 categories at the three digit level. As was noted earlier in Section 2.0, Literature Review, the UCD classification system most closely meets the identified criteria, and is the most commonly used.

The specific reference for UCD codes employed in this study is presented in Appendix A.

In order to simplify reporting of data and computer modeling for projection, it was decided that the 14 category, consolidated UCD code (CUCD) should be employed, as per Proctor and Redfern et. al. (1982). Appendix B lists these 14 simplified categories, grouping the UCD classified wastes together according to similarity of physical and chemical characteristics, and methods of treatment.

Each Hazardous Waste Data Report consisted of two pages printed on both sides containing 18 questions for the manufacturing version and 17 questions for non-manufacturing and institution versions.

Samples of the three types of questionnaires are included in Appendix D.

4.2 Pretest of Questionnaire

Since the design and administration of the questionnaire were key to the success of the survey, the questionnaire was pretested using a small sample of generators. The pretest had the following objectives:

- Clarify ambiguities;
- Improve the structure and order of questions;
- Identify questions which respondents were hesitant to answer; and
- Produce a small quantity of data for trials with the WASTES[10] forecasting model.

A group of 17 generators was selected for the pretest, of whom 9 were tentatively identified as major generators. Of the total, 7 were designated as manufacturers, 8 as non-manufacturers and 2 as institutions, with the corresponding questionnaire type being directed to each.

Each of these establishments was telephoned directly by Corporation staff prior to sending out the questionnaire, in order to inform them of the nature of the survey and pretest, as well as to encourage response. Questionnaires were sent via courier rather than by mail, as a deliberate method of drawing attention. As follow-up, each respondent was contacted and interviewed by telephone by a technical staff member.

Two problems identified by the pretest were:

- The sensitive nature of some firms to a request for dollar sales volume. This question was dropped from the final version of the questionnaire.

- Confusion from a lack of definition of a hazardous waste "stream". A definition of a hazardous waste stream being "all hazardous wastes mixed and disposed of together" was added to the Reference Page of the questionnaire.

The problems of response delay persisted through the survey pretest. By the end of the third week after initial questionnaire administration, 9 of the 17 forms had been received; by the end of the fifth week, 11 forms had been returned. All pretest questionnaires were eventually completed and returned.

4.3 Survey Strategy

Major/Minor Definition

Based on earlier work in the Province[8], and information presented in other reviews as noted earlier, it was understood that a relatively small number of large establishments in the Province accounted for a significant proportion of hazardous waste generation. These were deemed to be the "Major Generators" of hazardous waste, and their number was initially established to be on the order of 50 to 100 establishments.

A flexible definition of "Major Generators" was used with most companies producing in excess of 10 tonnes/year of hazardous waste. The nature of the waste, as well as the uniqueness of the industry involved, were also considerations for inclusion as major generators.

"Minor Generators" were defined, by default, as those establishments which accounted for the remaining smaller proportion of hazardous waste.

Major Generators:

Due to their significance, and the relatively small numbers involved, a census approach was adopted for major generators. A targeted census implies contacting and receiving information from all the establishments within this category. A complete response from all major generators was however not deemed practical; therefore, for management purposes, a targeted response of 80% from designated major generators was established. All designated major generators were sent a questionnaire and received special consideration in recontacting to ensure maximum response. In addition, the information supplied by major generators was reviewed more thoroughly to ensure completeness.

The main problem with major generators was identification. Although their number was assumed to be relatively small, an exhaustive list could not be prepared with certainty. This problem was addressed in the following two ways:

- A set of approximately 185 establishments was initially identified for inclusion in the major generator category. This list was based on Provincial generator registration, and the experience of Corporation and Consultant staff. This list was larger than the estimated number of major generators, approximately 50 to 100, and was intended to include as many probable major generators as possible.

- The sampling of minor generators was structured, in part, to seek out major generators not initially identified. In SIC categories where it was likely that significant quantities of waste could be generated, all establishments, or larger numbers of establishments, were included in the survey. Those establishments sampled as minor generators, but identified later as major, were transferred to the major generator group.

Minor Generators:

The method chosen to survey the minor generators was a stratified statistical sample, with SIC employed as the basis for stratification. This implied that the sample of potential minor generators would not be chosen totally at random; instead, a number were selected from each SIC over the entire range of SIC categories. Stratification by SIC was employed for the following two reasons:

- A stratified, rather than fully random sampling ensures that entire SIC groupings are not missed; and
- It was assumed that establishments within each individual SIC grouping would have greater homogeneity, resulting in a smaller sample size to cover each SIC, and reducing variance.

It is evident that establishments within certain SIC categories are more likely to generate hazardous waste. In such categories, such as SIC 28 - Chemical Production Industries, a complete or larger sample was drawn. Such complete or greater sampling was also employed in order to search for potential major generators. For other SIC categories that were less likely to generate hazardous waste, likely to generate only a small quantity, or where there were too many establishments to include all, a random sample was taken within the SIC. A reasonable sample size was selected, depending on the number of establishments identified in the SIC. Thus, for the minor generators, either all the establishments, or a random sample of establishments was selected within each SIC.

The initial target response for minor generators was to receive a sample of 350 responses overall. In order to obtain this target, a much larger number were sent questionnaires. As discussed later in the Questionnaire Development and Implementation section of the report, a total of 1131 questionnaires were sent to establishments designated as minor generators. This number was large in order to make allowance for a potential lower percentage return, as well as incorrect addressing and closure of establishments.

The sizes of the samples of major and minor generators selected in individual SIC categories are provided in Appendix E, along with total numbers of establishments identified within SIC's.

The main source used to select the sample of minor generators was a list of 5000 companies purchased from Dun and Bradstreet. This list, which was provided in dBase III format, included the company name and address, as well as a contact name. It also included the primary SIC for each company and the number of employees.

The major secondary sources of information were as follows:

- Scott's Directory of Manufacturing Companies for Western Canada - This source also classified companies according to U.S. SIC, but only included those in manufacturing categories;

- Schools in Manitoba, 1988 - This source from the Communications Branch of Manitoba Education was used to select school divisions for the sample;

- 1988 Facility List of Hospitals and Nursing Homes - This source was used to select hospitals and personal care homes; and

- Chamber of Commerce Membership List - This source was used as an additional source of information.

4.4 Contact Strategy

For all major and minor generators, the administration of the questionnaire involved the mailings of the following three components:

- Initial Introductory Letter - This letter was written and mailed directly by the Manitoba Hazardous Waste Management Corporation. It explained the nature and purpose of the Corporation and the survey, and also introduced the Consultants involved in the administration of the questionnaires.

- Questionnaire Set - One of three different questionnaires, either manufacturing, non-manufacturing, or institution, was sent to each establishment several days after the initial letter of introduction. A cover letter from the Consultant was included along with an addressed, stamped envelope with which to return the questionnaire. The cover letter provided additional instructions and information, as well as directing problems in either interpretation or administration to the Consultant.

- Follow-up Letter(s) - A follow-up letter by the Consultant was sent to all Major and Minor generators about one week after the questionnaire was sent out. The letter urged response and directed any questions back to Consultant personnel. A second follow-up letter was later sent to all non-responding Minor generators.

Sample copies of the letters and questionnaires are included in Appendix D.

Given the large number of establishments involved in the sample, the mailing was broken down into several groups listed in Table 4. A four digit code number for identification was developed to provide anonymity to individual establishments and to differentiate between mailing groups.

TABLE 4

Questionnaire Mailing Groups Identified by ID Code Series

ID Series	Mailing Group	Number in Group
0100	Pretest	17
1000	Initially Identified Majors	97
2000	First Set Minors (all SIC taken)	417
3000	Additional Majors (registered)	79
4000	Second Set Minors (random sample)	706
5000	Additional Majors and Minors	9
	Total	1325

For the major generators, it was decided to pursue further recontact by telephone in an attempt to obtain as many returns as possible. The recontacting operation was conducted by non-technical staff whose role was as follows:

- Ascertain key contact individual (especially if different from the name on the mailing);
- Establish contact with that person;
- Urge response as soon as possible;
- Determine if there were any "contacting" problems, such as lost questionnaires;
- Direct technical questions to process engineering staff; and
- When necessary, transcribe information over the telephone to complete forms.

For the major generators, the decision was made to employ a census type approach, desiring receipt of information from all establishments so identified. Given the limited time and resources available, receipt of all could not be practically expected. A target of 80% receipt of questionnaires was established in order to judge when to discontinue active pursuit of information.

4.5 Evaluation of Responses

While the recontacting process was underway, technical staff reviewed all data received. The information derived from major generators was treated somewhat differently than that from minor generators. In the case of major generators, technical staff had the following responsibilities for each waste stream identified:

- Assignment of the most appropriate SIC category;
- Review of waste information in terms of the process to determine if quantities seem appropriate, and if there may be any other unidentified waste streams likely from the process;
- Assignment of UCD code, consolidated UCD code and waste name to be used in the database;

- Determination of waste quantity, including the assumption of a specific gravity in the case of liquid wastes; and
- Recontact, if necessary, to ensure correctness/completeness of information and to obtain additional process related information.

In the case of the minor generators, technical staff had the following responsibilities:

- Review of questionnaire for completeness; and
- Assignment of UCD code, consolidated UCD code and waste name to be used in the database.

During the review of information, judgements were also made as to whether to reassign an individual generator to either the major or minor generator category.

5.0 SURVEY RESULTS

5.1 Numerical Response

At the beginning of the survey, targets were established for response to the questionnaire, although these were primarily for management purposes. As was noted in Section 4.3, Survey Strategy, the desired targets were 80% for major generators, or approximately 145 respondents, and 350 returns for a 30% response for the minor generators.

At the completion of the survey, 111 major generators had returned questionnaires. This represented just over 60% of those initially identified in this category. Correspondingly, 272 minor generators had responded. An additional 25 responses were received by telephone or in person, most indicating that they did not generate hazardous waste materials. This represented a total of 297 responses from minor generators. A further 30 Major generators and 20 minor generators were re-contacted by the Corporation to increase the total number of responses to 131 major and 317 minor generators for response rates of 71% and 28% respectively.

5.2 Survey Data

Table 5 represents the total quantity of 178,290 tonnes of waste reported in the survey. The waste is reported by quantity for the Major generators, Minor generators, and total waste for each CUCD waste type.

TABLE 5

Survey Data

CUCD	Waste Type	Reported Quantity (tonnes/year) Majors	Minors	Total
1	Organic Sludges	175.6	2.5	178.1
2	Solvents	368.4	57.1	425.5
3	Oils & Greases	597.2	264.2	861.4
4	Oil/Water Mixtures	36.0	0.5	36.5
5	Organic Residuals	0.2	1.4	1.6
6	Inorganic Solutions	156,618.8	772.5	157,391.3
7	Misc. Chemicals	25.3	75.2	100.5
8	Paint Residuals	276.0	14.1	290.1
9	Aqueous Organics	13.4	39.2	52.6
10	Anion Complexes	18,657.4	0.0	18,657.4
11	Inorganic Sludges	263.9	0.0	264.0
12	Pesticide & Herbicide	0.0	2.3	2.3
13	PCB Waste	16.2	0.1	16.3
14	Clean-up Residuals	2.4	10.0	11.4
	Total Survey	177,050.9	1,239.1	178,290.0

PART II WASTE MARKET CHARACTERIZATION

1.0 DISCUSSION

1.1 Waste Management Scenarios

Prior to the development of the Waste Market Characterization it was necessary to identify the potential waste management scenarios to provide a rational basis for the characterization. The possible management scenarios identified are; management at source, collective management at a generation site and collective management at a central treatment facility. Environmentally acceptable management options for these scenarios include reuse, recycling, treatment and disposal.

Although the survey information indicated that a minimal amount of waste is currently being managed by the options identified, this will change in the future as the level of regulatory enforcement increases. The selection of the appropriate management scenario will be based on cost, convenience and availability of treatment and disposal facilities. It is most likely that as environmentally acceptable waste management practices are implemented in Manitoba, all of these waste management scenarios will be employed. In order to better predict this type of waste market, it was proposed that the market characterization identify all hazardous waste requiring management or available to a management system, and selectively identify wastes that would appropriately be managed at a central treatment facility. After assessing the survey data, the following general assumptions were made respecting the selection of management scenarios:

- Large dilute waste streams generated by individual companies would be managed at source and the residues from their treatment managed at a central treatment facility;

- Large waste streams that are generated by a large number of companies and are suitable for reuse (i.e. fuel blending) would be managed by off-site services, separate from a central facility

- Small waste streams that have the potential for recycling should be partially discounted based on the nature of the waste and reflecting the mix of management scenarios.

The waste market identified in this work corresponds to the various components of the overall hazardous waste management system under development by the Corporation, either directly or in association with others. The components of this system are:

- Management at source by on-site treatment, recycling reuse, or reduction.

- Management off-site by specialized treatment or alternative use as practiced by existing or future commercial operations. (i.e. re-use as industrial auxiliary fuel, solvent recycling.)

- Management by longer term storage until treatment is available. (i.e. PCB's)

- Management off-site by provision of central treatment and disposal in facilities in the province or by export to such facilities elsewhere.

1.2 Stages of Data Development

Two pieces of information are necessary from this work to develop commercial strategies, a corporate business plan and provide input to facility development:

- The quantity and type of waste available to the overall System, including recycling and on-site or other waste management options; and
- The quantity and type of waste available to a central facility.

With this objective in mind, five stages of data development (table 6) were considered necessary to establish the characterization methodology. The first stage incorporated a review of the survey data, the second stage an assessment, correction, and addition of data to the survey, the third stage an adjustment of the corrected data to include any on-going and expected future waste management initiatives by the waste generators, the fourth stage an extrapolation of the previously characterized data to include the total population of waste generators, and finally, the projection of the extrapolated data to the market expected to be available to the Corporation, the "Facility" data.

TABLE 6
Stages of Data Development

	Stage	Process
1	Survey Data	Compiled by Consultant
2	Adjusted Data	Data evaluated and adjusted
3	Characterization Data	Data exclusion
4	Extrapolated Data	Extrapolation of characterization data
5	Facility Data	Estimation of quantity of waste available to a central treatment facility

The following sections detail the processes used to arrive at the final stage of estimated facility data from the original survey data.

2.0 CHARACTERIZATION METHODOLOGY

2.1 Assessment of Survey

During the first stage of data development, the Corporation performed a critical evaluation of the survey information received from the Consultant. Any data inaccuracies and

omissions were identified, including the presence of some non-hazardous waste streams, the use of source based waste management, waste accumulated over a period of years, and any anomalous or incomplete data.

2.2 Generator Follow-up

At the termination of the study, approximately 30 of the major generators had not responded. Because this represented a possible significant quantity of un-reported waste, these generators were contacted repeatedly until completed questionnaires were received. Most of these generators required a second or third set of questionnaires to replace the original.

Where it was determined by telephone contact that the waste quantity and diversity was not significant, the data was acquired by telephone. Where necessary, information was obtained through on-site waste audits performed by Corporation staff.

In order to survey industry groups which had been missed and to obtain information for extrapolation of groups which had been sampled, with no available information in the source listings, an extra 1000 company update of the Dun and Bradstreet listing was ordered. All of the missed industry groups were comprised of minor generators. For those considered to be important, from the perspective of expected significant waste quantity or type, information was obtained through telephone contact in order to expedite the process. Other industry groups considered to be relatively unimportant because of expected waste quantity or type, were left for future updates of the data. Where information from large industry groups was non-representative, more samples were taken. Data evaluation and extrapolation was continued throughout the re-contacting process.

2.3 Data Evaluation and Adjustment

The next step was evaluation and adjustment of the data to provide a realistic basis for extrapolation and projection purposes. The adjustments included the addition of new data, removal of non-hazardous waste streams, discounting of wastes being recycled, correction of data derived from several year's accumulation, and the correction of anomalous or incomplete data as noted in section 2.1, Assessment of Survey.

Table 7 represents the adjusted data as discussed above

TABLE 7

Adjusted Survey Data

CUCD	Waste Type	Quantity (tonnes/year)
1	Organic Sludges	212.1
2	Solvents	441.9
3	Oils & Greases	888.9
4	Oil/Water Mixtures	538.1
5	Organic Residuals	8.5
6	Inorganic Solutions	1,460,094.9
7	Misc. Chemicals	24.7
8	Paint Residuals	288.7
9	Aqueous Organics	337.8
10	Anion Complexes	19,964.1
11	Inorganic Sludges	3,504.2
12	Pesticide & Herbicide	2.3
13	PCB Waste	16.3
14	Clean-up Residuals	222.2
	Total Survey	1,486,244.7

2.4 Rationale for Exclusion

The extrapolation and projection process was designed to provide information relating to the quantity of waste which would be available for treatment and disposal. To this end, the corrected data was reviewed and factors applied relating to the capturability of the waste by a hazardous waste management system, and the quantity available to a facility.

Wastes which would undergo on-site waste management were discounted by an appropriate factor which incorporates the amount of sludge or residues produced. Information given on the various waste streams, including analytical data where available, was used to determine the appropriate factor to reduce the waste quantities. The final quantity of waste resulting from this process represents the waste available to a waste management system for treatment and disposal.

In many industries the quantities of waste were very large, with correspondingly low concentrations of the hazardous component(s). These industries are either in the process of waste minimization, or will be in the near future due to the evolving nature of the regulations and enforcement. Therefore a limited percentage, consisting of the expected residual sludge or toxic component of their reported waste, was included in the final

quantity available. The amount of expected sludge or residual toxic component was determined from analytical data or knowledge of the contents of the waste stream.

Some of the wastes generated could be cost effectively recycled, leaving only the residues or sludge requiring disposal. These wastes must be discounted by the percentage of waste which is recycled. Generally, solvents and bag house dust metal fines are the types of wastes which can be recovered and recycled. Occasionally a company will refuse to recycle a waste, preferring the disposal option. This action was also taken into account when determining the projected waste quantities by including the waste in the projection procedure.

Other wastes are amenable to on-site treatment. One example of this is neutralization of corrosive waste streams. Another example is biological degradation of waste streams containing dilute organic wastes. CUCD 6, Inorganic Solutions, contains several such waste streams. Those which were only acidic or basic were totally discounted, whereas those which contained other contaminants were discounted by a percentage which allowed for the removal of the non hazardous portion.

Table 8 represents the data following the data exclusions as discussed above.

TABLE 8

Waste Market Characterization Data
(Un-extrapolated)

CUCD	Waste Type	Quantity (tonnes/year)
1	Organic Sludges	212.1
2	Solvents	441.9
3	Oils & Greases	888.9
4	Oil/Water Mixtures	538.1
5	Organic Residuals	8.5
6	Inorganic Solutions	1,681.5
7	Misc. Chemicals	24.7
8	Paint Residuals	288.7
9	Aqueous Organics	337.8
10	Anion Complexes	1,689.5
11	Inorganic Sludges	3,504.2
12	Pesticide & Herbicide	2.3
13	PCB Waste	16.3
14	Clean-up Residuals	144.9
15	Pathological Waste	77.3
	Total Survey	9,856.7

2.5 Extrapolation/Projection Process

A database compatible with existing capabilities was utilized for data storage and manipulation. Information on Manitoba companies for extrapolation purposes was obtained various sources of statistical information, with statistics Canada and Manitoba Bureau of Statistics information being used for confirmation. Based on similar studies, and from prior knowledge of the wastes in Manitoba, it was determined that extrapolation should be done utilizing a waste generation rate per employee. From the statistical information of the number of companies and the number of employees per company, the reported wastes were then extrapolated over the SIC groups which had been sampled. While recognizing the fact that they would not be all encompassing, the following two assumptions were made:

- The rate of production is similar within the 2, 3, or 4 digit SIC groups; and
- The type of wastes generated are similar within the SIC groups.

During the extrapolation process, the results were continually reviewed to identify any anomalies. Some problems were evident where a few companies produced different types of waste than other companies in the same SIC group. Two corrective measures were taken to address these anomalies:

- In some cases the wastes were not extrapolated over the SIC group. Alternatively, the anomalous data was placed in the miscellaneous category, SIC 99 as un-extrapolated data. The remaining reported data was then extrapolated.
- In some 4 digit SIC groups which contained incompatible data, all companies were surveyed by telephone instead of using a sample group.

Other errors were introduced by inaccuracies in the statistical information, and in information supplied by the companies themselves.

Table 9 below represents the total extrapolated data.

TABLE 9
Extrapolated Data

CUCD	Waste Type	Quantity (tonnes/year)
1	Organic Sludges	299
2	Solvents	708
3	Oils & Greases	5,668
4	Oil/Water Mixtures	1,026
5	Organic Residuals	86
6	Inorganic Solutions	2,993
7	Misc. Chemicals	71
8	Paint Residuals	639
9	Aqueous Organics	666
10	Anion Complexes	6,138
11	Inorganic Sludges	4,034
12	Pesticide & Herbicide	12
13	PCB Waste	16
14	Clean-up Residuals	44
15	Pathological Waste	279
	Total Extrapolated	22,679

From the extrapolated data, "capturable waste", i.e. wastes that would be available to the Corporation's management system, were manually estimated for each CUCD category, discounting those wastes which are currently being managed. These wastes were discounted by the estimated percentages that were being managed. As can be seen by comparison of the table 9 "Extrapolated Data" and table 10 "Waste Market Available to Central Treatment Facility", the total extrapolated amounts of some CUCD waste categories were presumed to be capturable due to the nature of the waste and the market.

Table 10 below represents the quantities of waste assumed to be available to a central Treatment Facility.

TABLE 10

Waste Market Available to Central Treatment Facility

CUCD	Waste Type	Quantity (tonnes/year)
1	Organic Sludges	299
2	Solvents	354
3	Oils & Greases	0
4	Oil/Water Mixtures	103
5	Organic Residuals	17
6	Inorganic Solutions	2,993
7	Misc. Chemicals	71
8	Paint Residuals	639
9	Aqueous Organics	666
10	Anion Complexes	6,138
11	Inorganic Sludges	2,295
12	Pesticide & Herbicide	75
13	PCB Waste	500
14	Clean-up Residuals	1044
15	Pathological Waste	0
	Total Available	15,194

3.0 RESULTS

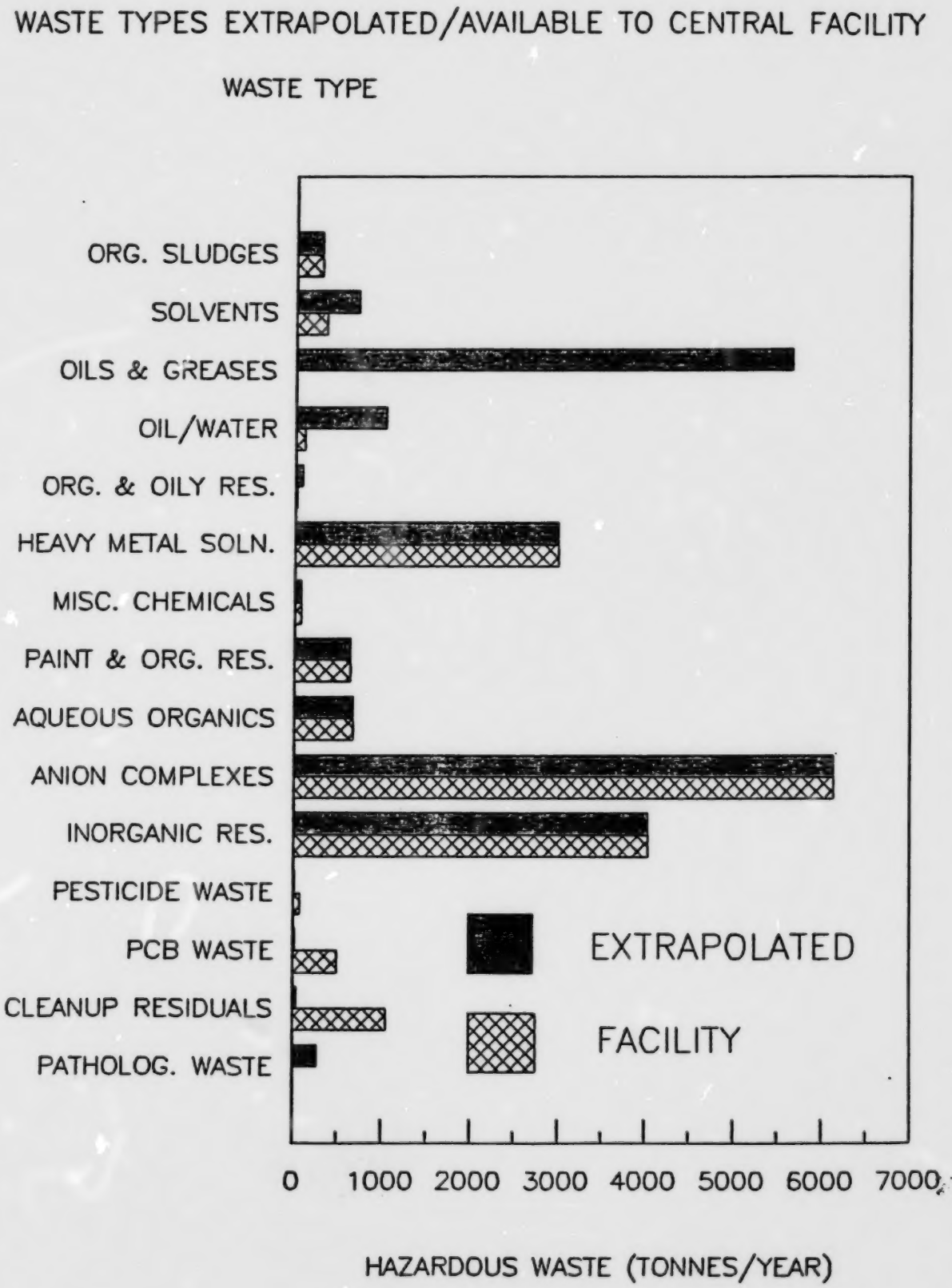
3.1 Extrapolated database

The extrapolated database was obtained by correction and extrapolation of the reported data as outlined in the previous sections. This data is considered to be the total waste market, and consists of 22,679 tonnes of hazardous waste per year expected to be available to the system. Included in this is 6,780 tonnes of waste oil and various waste oil mixtures, 2,641 tonnes of other organic wastes, and 13,258 tonnes of inorganic wastes. The database will continue to evolve as further information is acquired.

3.2 Waste Availability and Distribution

The total extrapolated quantity of waste available to the system as presented in table 9, Extrapolated Data is also presented pictorially in figure 4, a map of Percentage of Hazardous Waste Per Region. The projected quantities were critically analyzed and factors pertaining to the availability of the wastes to a central treatment facility were applied to produce table 10, Waste Market Available to Central Treatment Facility. The results are also presented graphically on Figures 2 and 3. The total available waste was determined to

FIGURE 2


WASTE TYPES EXTRAPOLATED/AVAILABLE TO CENTRAL FACILITY
WASTE TYPE
ORG. SLUDGES
SOLVENTS
OILS & GREASES
OIL/WATER
ORG. & OILY RES.
HEAVY METAL SOLN.
MISC. CHEMICALS
PAINT & ORG. RES.
AQUEOUS ORGANICS
ANION COMPLEXES
INORGANIC RES.
PESTICIDE WASTE
PCB WASTE
CLEANUP RESIDUALS
PATHOLOG. WASTE
EXTRAPOLATED
FACILITY
0
1000
2000
3000
4000
5000
6000
7000
HAZARDOUS WASTE (TONNES/YEAR)

CHARACTERIZATION OF WASTE
EXTRAPOLATED/AVAILABLE TO CENTRAL FACILITY

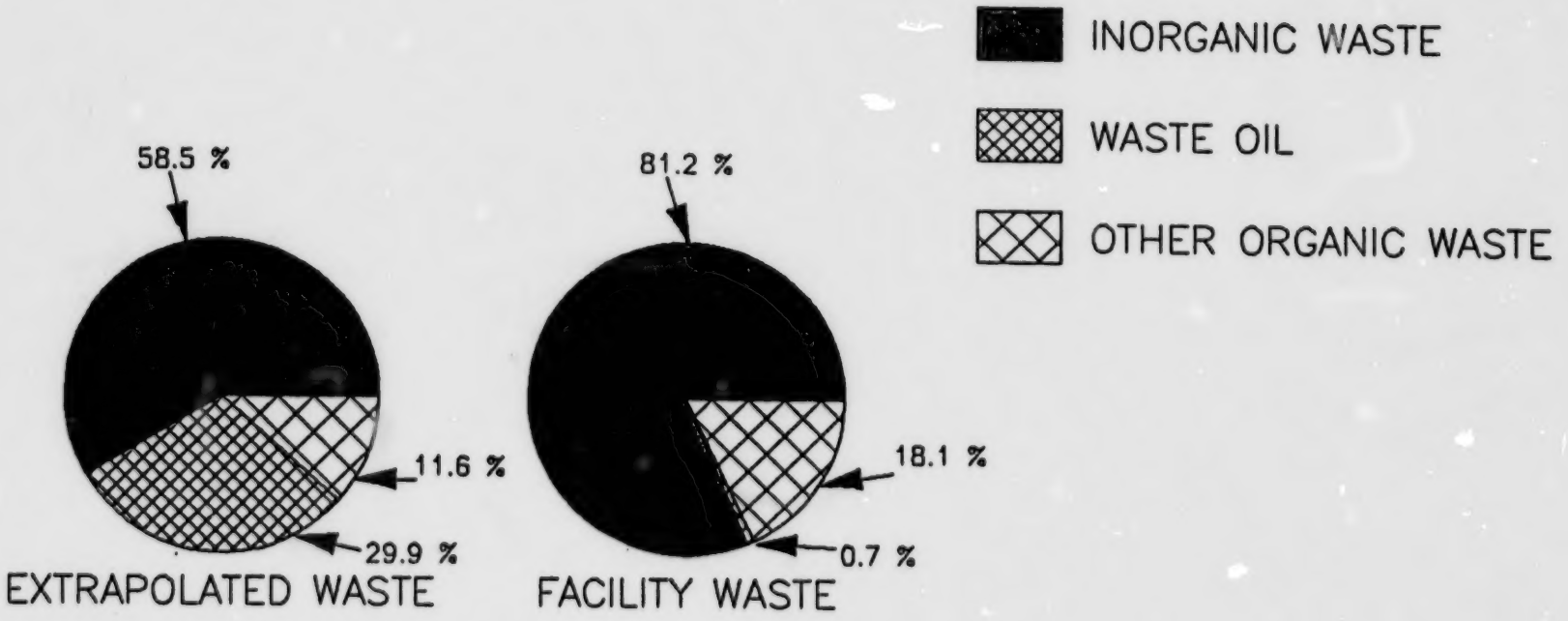
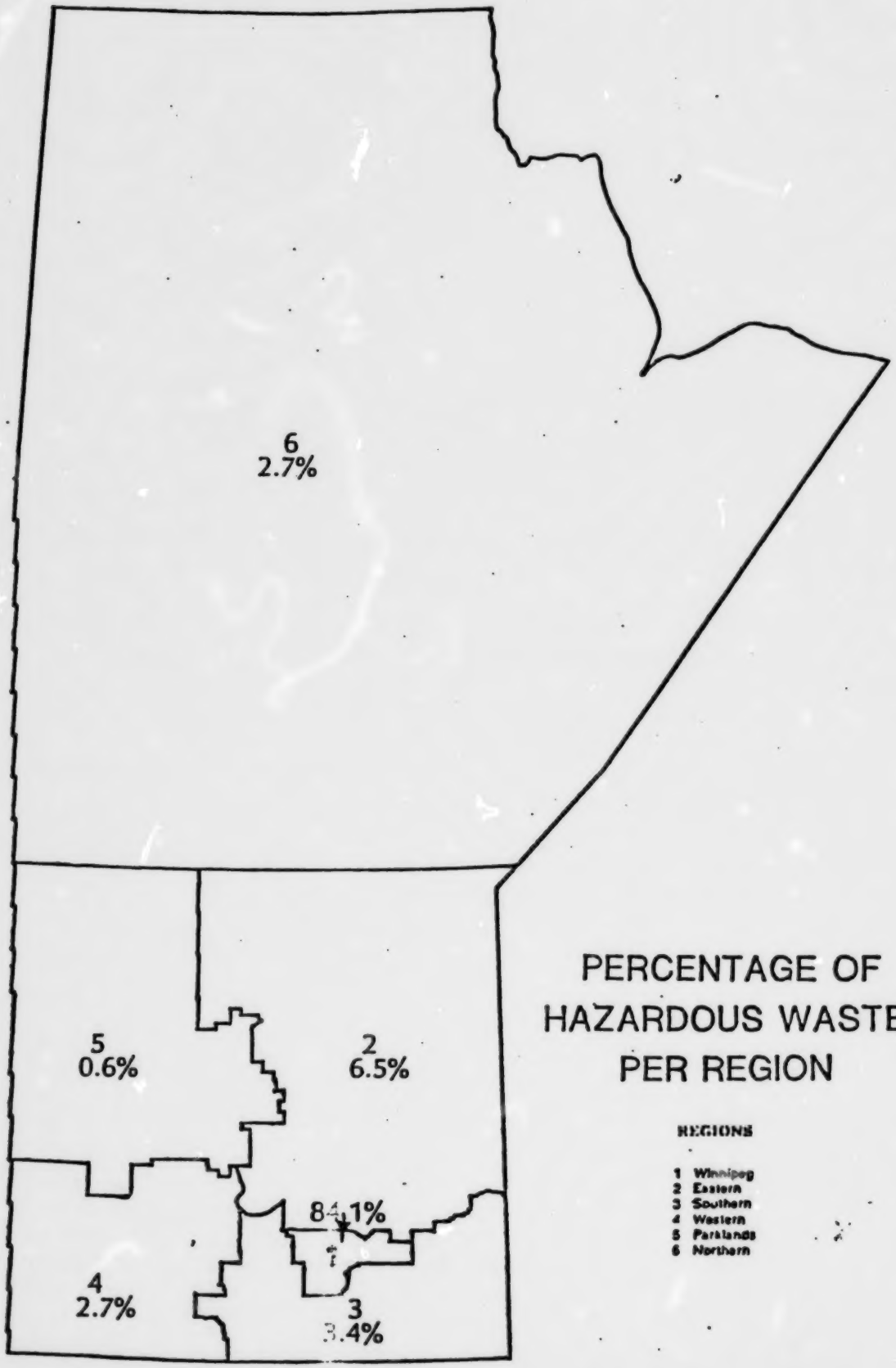


FIGURE 3

FIGURE 4



PERCENTAGE OF HAZARDOUS WASTE PER REGION

REGIONS

1 Winnipeg
2 Eastern
3 Southern
4 Western
5 Parklands
6 Northern

be 15,194 tonnes per year, of which 3,197 (21%) tonnes is organic in nature (including some waste oil and 544 t/y from CUCD 14), and 11,997 (79%) is inorganic in nature (including 500t/y from CUCD 14). The Provincial regional[1] distribution of the total extrapolated waste was determined to be as follows:

	REGIONS*	QUANTITY
1	Winnnipeg	84.1%
2	Eastern	6.5%
3	Southern	3.4%
4	Western	2.7%
5	Parklands	0.6%
6	Northern	2.7%

* Where the six regions correspond to the Provincial Public Health Inspection Services regions.

The regional quantities are further graphically represented in Figure 5.

Figure 6 graphically represents the present handling of hazardous waste disposal as reported by the generators.

The breakdown of waste types in the Winnipeg region is shown on Figure 7, Waste Type Distribution of Winnipeg Region. This illustrates the predominance of inorganic waste requiring proper treatment and disposal.

3.3 Comparison to Previous Information

As discussed in Part 1, section 2.0, a previous study by Yee et al. (1985)[8], was used as a reference base for this work.

Direct comparison of the 1985 study to this work is not possible due to differences in data compilation procedures. It is, however, useful to compare the final results, and some important findings. Specific differences are:

- Yee et al (1985) used no extrapolation procedures.
- The 1985 report utilized TDG classes for waste, whereas this work made use of the UCD waste classification system. The TDG classification system is the regulatory tool for classification of dangerous goods and hazardous waste for shipping purposes, whereas the UCD system is designed to classify wastes according to disposal procedures.
- A small number of large hazardous waste streams were included in the 1985 report, creating erroneously large waste quantities for particular industry types. This factor also affected the regional quantity estimations. In particular, SIC's 28(chemicals), 26(paper and allied products), and

REGIONAL DISTRIBUTION OF EXTRAPOLATED HAZARDOUS WASTE
22,679 TONNES/YEAR

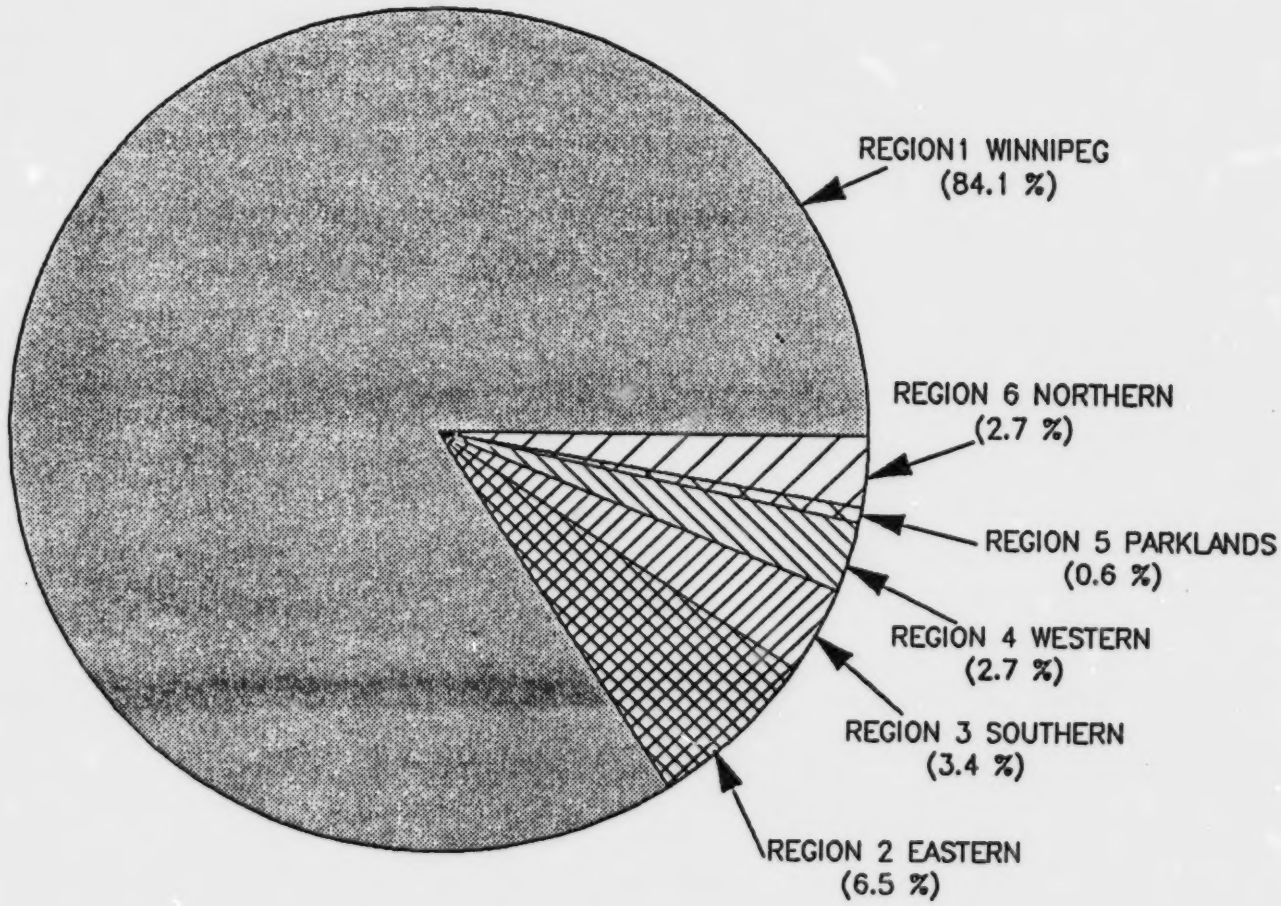


FIGURE 5

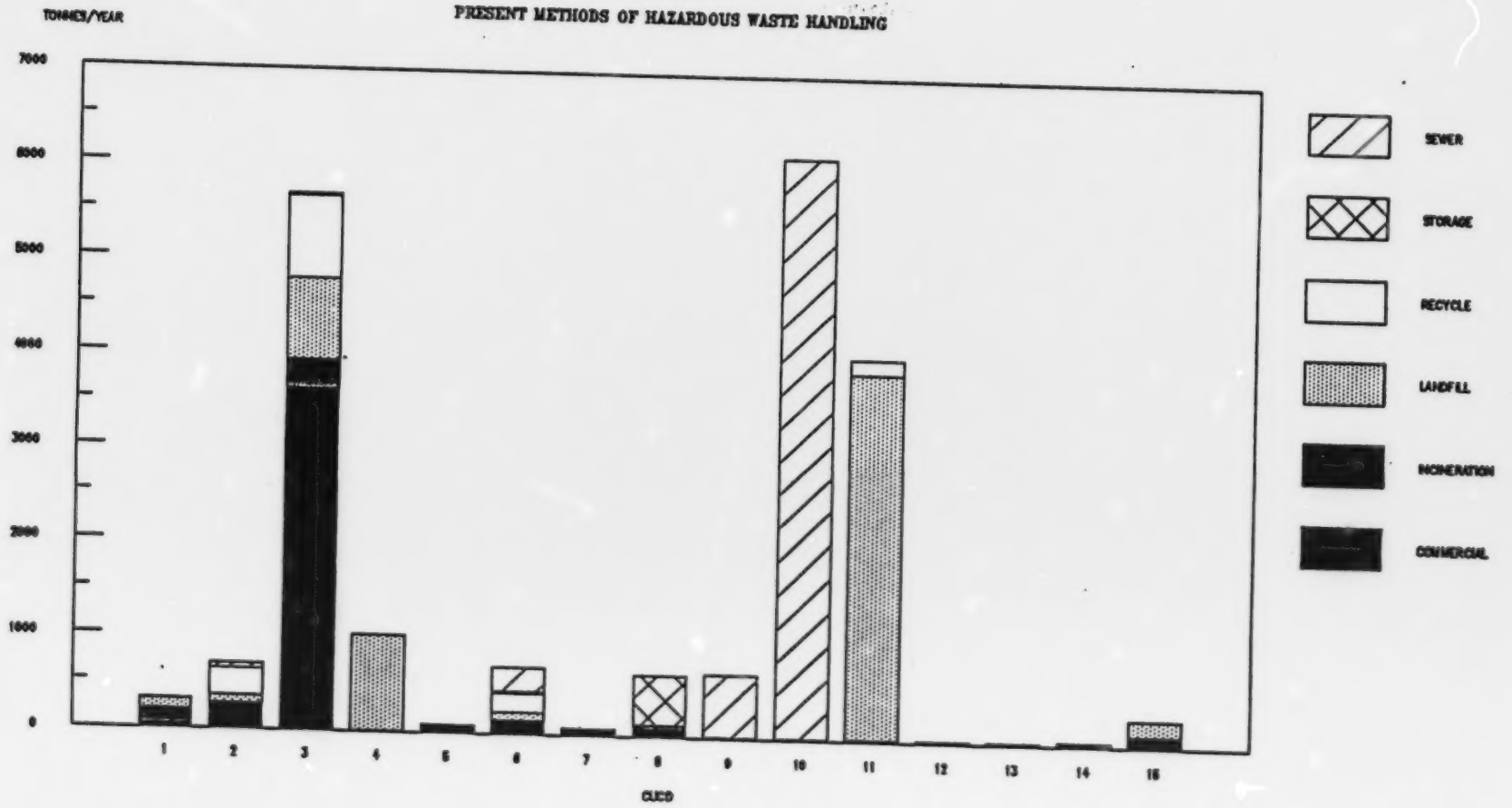

PRESENT METHODS OF HAZARDOUS WASTE HANDLING
TONNES/YEAR
7000
6000
5000
4000
3000
2000
1000
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
CLASS
SEWER
STORAGE
RECYCLE
LANDFILL
INCINERATION
COMMERCIAL

FIGURE 6

WASTE TYPE DISTRIBUTION OF WINNIPEG REGION

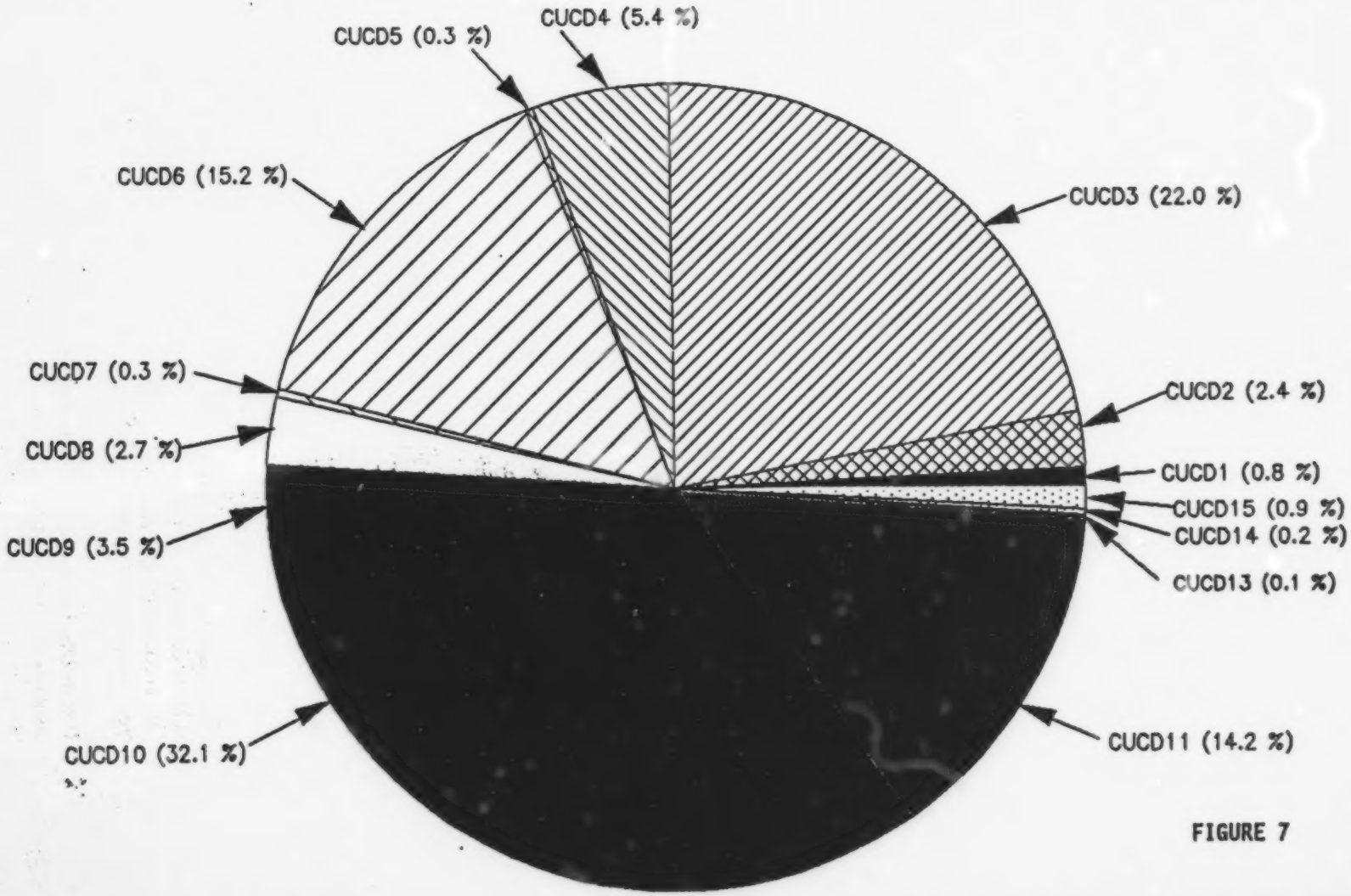


FIGURE 7

10(mining) included large quantities of non hazardous waste from a small number of companies.

- Hazardous waste produced by some companies was not included in the 1985 report. One of the waste types is waste oil, which was not considered to be a hazardous waste at the time. Waste oil is included in many of the SIC's in this work. The wastes produced by SIC's 34,(fabricated metals), and 33(primary metals) were also significant quantities which were missed in the 1985 report.

- The 1985 report only considered the larger companies, with no sampling of small companies.

- The service industries were not surveyed for the 1985 report.

- The results of the present work did not include SIC's which were shown in the 1985 report to produce negligible quantities of waste, and which after consideration would not in the future be expected to produce any waste. In particular, SIC's 15(building construction), 17(construction trade), 23(apparel), 39(miscellaneous manufacturing), and 50(wholesale durable goods) were not considered to produce any significant quantities of hazardous waste.

The final total quantity of 20,235 tonnes of hazardous waste reported in the 1985 report compares favorably with the result of this work of 22,679 tonnes. Although there are significant differences in the collection and reporting of data, they tended to cancel each other out. The 1985 report included data from more companies than were included in this work, 663 as compared to 448, where all 663 were the larger companies within an industry group. This factor tended to cancel out the fact that the data was not extrapolated over the whole industry population. The second contributing factor was the inclusion of non-hazardous waste in the 1985 report.

An important result of both studies was that the majority of hazardous waste was produced by a few large generators, with a large number of small generators producing the remainder.

4.0 CONCLUSIONS

4.1 Discussion

The waste market characterization has provided the Corporation with a comprehensive current estimate and assessment of hazardous waste generated within Manitoba, taking into account source based management, recycling, and collective management at a central treatment facility and other facilities.

The results indicate that the portion of the hazardous waste market which would be available to a central treatment and disposal facility in the province of Manitoba is mainly inorganic in nature. Specifically, the majority of wastes are from those industries

categorized in CUCD's 6, 10, and 11, those generating heavy metal solutions, anion complexes, and sludges and inorganic residuals.

Of major significance is the presence of several large, but very dilute waste streams which comprise the bulk of the inorganic wastes. These waste streams, although they are presently being discharged to the sewer systems, would not likely be treated at the facility. In order to be cost effective, on-site treatment by the waste generator would be the logical alternative to reduce the volume and concentrate the hazardous waste as residues or sludges. In some cases, the estimation of the residuals resulting from this onsite treatment was difficult to quantify, requiring implicit knowledge of the individual waste streams; thus, a sampling program for some wastes (SIC 34 - fabricated metals) was initiated to provide the required information. In addition, the degree to which the waste generator was prepared to deal with the management problem had to be addressed.

With respect to the organic wastes, waste oil was determined to be the largest single waste stream, for which there are several disposal alternatives. The waste generator can either arrange for thermal destruction, if the quantities are large enough, or have the waste handled collectively through a waste fuel blender. Spent solvents can be recycled, or blended as waste fuel for incineration.

These findings are significant to facility design work. Facility processes will correlate to the treatment of mainly inorganic wastes, with the addition of some capability to handle certain organic waste streams. The organic wastes may simply be handled in preparation for shipment to other waste management facilities for treatment and disposal.

4.2 Waste Market Characterization Application

The information obtained from the study is being used for two areas of development:

- Development of off-site system component scope; and
- Input to specific facilities design.

Based on the reported survey data of 178,290 tonnes per year, it is expected that the majority of the waste will be subjected to on-site management and reduction, leaving 22,679 tonnes of hazardous waste produced yearly which require some form of off-site treatment or disposal. Of that quantity, 15,194 tonnes/y is expected to be available to a central treatment facility. 11,997 tonnes/y is inorganic and would be most cost effectively treated in the province. A Consultant has been retained to provide the basic design and sizing of facility components from this information. Some allowance will also be made for the 3,197 tonnes of organic waste which require some form of pre-treatment prior to shipping to out of province facilities, with the remaining 7,485 (mainly oil and solvents, but also some inorganics) being shipped directly for use as an auxiliary fuel, or handled by other operators.

The design and sizing component of facility development required a greater degree of definition of hazardous waste quantities by industry type (SIC), and waste type (CUCD). The waste type was separated into specific UCD wastes, with the inclusion of any available

data on concentrations of the hazardous components and the physical form (liquid, solid, sludge) of the wastes which would require treatment.

4.3 Maintenance and Future Projections

One of the requirements of the characterization methodology was that it be capable of easily up-dating the data base. This requirement has been met with the data base program feature which allows for data input and automatic recalculation of the projected quantities. As data becomes available through routine Corporation activities, or through future survey updates, it will be entered into the data base to provide an evolving, up to date basis for market characterization.

Additionally, the data will be used with the "Wastes" system to provide projection scenarios for future possible waste management activities, both by the generators and/or the Corporation. The purpose of the "Wastes" system is to assist in monitoring trends in the generation of hazardous waste. The present database, and economic, regulatory, and technological conditions are used as the base line model. Information about future conditions are used to provide forecasts of future waste generation.

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APPENDIX A

APPENDIX A
UCD Waste Classification System

SOURCE: Forrestal et. al. (1986)

UCD Classification Codes Relevant to Hazardous Waste

UCD CODE	DESCRIPTION	TYPICAL WASTES
11 Acidic Solutions		
111	Acidic Solution with Heavy Metals	Pickle Liquor Rinse Water
112	Acidic Solution with Other Metals and Non-Metals	Demineralizer Regenerent
113	Other Acidic Solution	Boiler Stack Scrubber water with Dilute Carbonic Acid
12 Alkaline Solutions		
121	Alkaline Solution with Heavy Metals	Rinse Waters from Surface Cleaning of Metals
122	Alkaline Solution with Other Metals	Demineralizer Regenerent
123	Other Alkaline Solutions	Cleanup Water from Lime of Cement Kiln
13 Metal Finishing Solutions		
131	Metal Finishing Solutions, Acid	Ammonia Based, Containing Copper, Tin,Lead or Cadmium
132	Metal Finishing Solutions, Alkaline	Contains Strong Complexing Agent and Copper, Tin, Lead and/or Cadmium
133	Spent Pickle Liquor from Ferrous and Non Ferrous Metals	Strong Acids with Iron, Fluoride, Hydrochloric Acid, Sulfuric Acid, Nitric Acid

UCD CODE	DESCRIPTION	TYPICAL WASTES
14 Other Aqueous Solutions		
141	Aqueous Solutions with Heavy Metals	Cleaning Solutions from Tanks, Trucks, or Railroad Tankers
142	Aqueous Solutions with Other Metals	Rinse Water from Heat Treating Salt Baths, Contain Barium, Aluminum
143	Aqueous Solutions with Reactive Anions	Bleaching Solutions Containing Sulfite, Chlorite, Fluoride, Bromate
145	Brine	Salt Solutions After Neutralization or Chlor/Alkali Production
146	Solutions Containing Cyanide	Plating Baths
147	Solutions Containing Sulfides	Plating Baths
15 Inorganic Solids		
151	Inorganic Solids	Foundry Sand with Phenolics
152	Inorganic Solid Chemicals	Aged of Off Spec. Chemicals Including Lime, Caustic Soda and Partial Containers of Laboratory Size
16 Other Inorganic Wastes		
165	Spent Catalyst	Maybe Carbon or Metal
167	Other Inorganic Waste	Ash and Construction Residue

UCD CODE	DESCRIPTION	TYPICAL WASTES
21 Spent Solvents		
211	Halogenated Solvents with Heavy Metals	Methylene Chloride, 1,1,1-Trichloro-ethylene used for Metal Cleaning
212	Halogenated Solvents with Other Metals	Surface Cleaning and Degreasing Solvents
213	Other Halogenated Solvents	Freon with Other Solvents Used in Chemical Processing
214	Non-Halogenated Solvents with Heavy Metals	Toluene, Benzene, Xylene Contaminated with Catalysts
215	Non-Halogenated Solvents with Other Metals	Acetone, Methylisobutylketone (MIBK) used in Paint and Varnish Formulation
216	Other Non-Halogenated Solvents	Methylethylketone and Other Solvents Contaminated with Dirt
217	Unspecified Solvents	Alcohols and Mixtures of Solvents
22 Other Organic Liquids		
221	Organic Liquids with Metals and Halogens	Dyes
222	Organic Liquids with Halogens Only	Chloroform, Carbon Tetrachloride
223	Organic Liquids with Metals Only	Nickelcarbonyl, Methyl Mercury
224	Other Organic Liquids	Creosote and Other Poly Aromatic Hydrocarbons
225	Aqueous Solution with Non-Halogenated Residues Less Than 10%	Laboratory Mixtures
226	Aqueous Solution with Halogenated residues Less Than 10%	Waste or Rinse Waters After Degreasing
227	Aqueous Solution with Non-Halogenated Organic Residue Greater Than 10%	Laboratory Mixtures
228	Aqueous Solution with Halogenated Organic Residue Greater Than 10%	Wash or Rinse Waters After Degreasing

UCD CODE	DESCRIPTION	TYPICAL WASTES
24-25 Other Organic Wastes		
241	Pesticides and Wastes	Partial Containers, Tank Washings, Off Spec. Product, etc.
242	PCB Oils and High Strength (over 500 ppm) Liquids	From Transformers and Capacitors
243	Pharmaceuticals and Wastes	Off-Spec. Drugs, Cleanup Waters, etc. Includes Items such as Vitamins
244	Photochemical waste	Most Solutions Non-Toxic Except those with Silver
245	Off-Spec or Aged Organics	Can Include Solids or Liquids. Generally in Containers
247	Halogenated Still Bottoms	Spent Solvent or Waste Oil Recovery
248	Non-Halogenated Still Bottoms	Solvent Recovery Operations
251	Tannery Wastes - Liquid	Solutions with Hexavalent Chromium
252	Solid or Sludge Tannery Wastes	Leather Shavings with Chrome
254	Adhesives or Glue	Waste Glues Mostly Aqueous. Some with Phenols
257	Phenolic Wastes	Phenolic Oil. Toluene Diisocyanide Residue
258	Waste Tar and Residues	
26 Polymeric Material Wastes		
261	Polymeric Resin	Polyester, Urethane, Etc.
262	Latex Wastes	Cleanup Water, Paint, Latex and Acrylic Resins
263	Other polymeric Wastes	Kettle Bottoms, Thermoplastic Resins
264	Thermoset Wastes	Urea-Formaldehyde and Thermoset Wastes

UCD CODE	DESCRIPTION	TYPICAL WASTES
28 Oily Wastes		
281	Waste Oil and Mixed Oil	Used Automotive Oil, Hydraulic Oil, Cutting Oil - May Contain Solvents or Metals
282	Oily Tank Bottoms	Crude Oil or Sludge from Storage
283	Oily Mud, Sediment and Water	Crude Oil Tanker Cleaning
284	Oily Acidic Solids	Solids from Emulsion Breaking and Re-Refining
285	Oily Alkaline Solids	Refining Solids
286	Oil/Water Separator Sludge	Oil Cooled Heavy Inorganics
288	Oily Wastes with Heavy Metal Contaminants	Steel Rolling Mill Sludges and Mill Scale
289	Oily Wastes with Water	Emulsions, Cleanup Water from Garages, Cooling Waters
41 Relatively Inert Sludges		
416	Ink Sludge	Sludge Could Contain Solvents, and Lead, Cesium, Chromium
417	Alum and Gypsum Sludges	Waste Water Phosphate. Removal Sludge
43 Metal Sludges		
431	Heavy Metal Sludge	Similar to that in 111, 113, 121, 123,132,133,141.
433	Other Metal Sludges	Ferric Chloride, Aluminum Oxide, etc.

UCD CODE	DESCRIPTION	TYPICAL WASTES
44-45 Other Sludges		
441	Lime Sludges	From Treatment of Acids and Similar to 431 and Derived from 111, 113, 121, 123, 131, 132, 133, 141
443	Sulfur Sludge	Desulfurization of Flue Gas Non-reactive but Very Low Bearing Strength
444	Cyanide Bearing Sludge	Pot Liners from Aluminum Reduction and Scrubber Sludge from Blast Furnace
445	Plating or Metal Finishing Sludge	Derived Mostly from 131, 132, 133
446	Degreasing Sludge	Grease and Oily Soil Containing Trichloroethane (TCE)
447	Tetraethyl Lead Sludge	Tank Bottoms
454	Paint Sludge	Drum Bottoms, Spills, Cleanup, etc.
455	Paint Sludge Without Heavy Metals	Mostly Latex
50-53 Miscellaneous		
509	Gas Cylinders or Containers	Oxygen Cylinders - Empty
512	Spill Cleanup	Oil/Soil Mixture
513	Laboratory Waste Chemicals	Partially Full Small Containers
518	Dust Collector Wastes	Dry Lime from Dust Control Baghouse
521	Spent Cartridge Filters	Air Cleaning Filters on Ventilation System
523	Tank Bottom Sediments	
528	Pathogenic Wastes	Used Bandages, Dressings
531	Contaminated Rags	Cleanup Materials
532	Equipment and/or Containers Contaminated with Pesticides	Empty Pesticide Cans

Other UCD Classification Codes

UCD CODE	DESCRIPTION	TYPICAL WASTES
144	Other aqueous solution	Aqueous solutions (14) other than 141, 142, 143, 145, 146, or 147
161	Asbestos-containing wastes	
162	Aluminum or tin wastes	
231	Organic solids with halogens	Polyvinyl
232	Organic solids without halogens	Polyethylene
253	Detergent and soap	Liquid, aqueous waste solutions and organic solids from production or cleaning operations
255	Unspecified organic wastes	Organics not listed in other categories
271	Sewage sludge	
272	Other Biological Wastes	Including animal fat, molasses wastes and dough
412	Filter Cake	Contaminated filter material, e.g. diatomaceous earth
413	Gas scrubber sludge	From gas cleaning operations
442	Phosphate sludge	
453	Paper sludge/pulp	Paper and cardboard manufacture source
456	Other waste treatment sludge	Sludges not otherwise identified due to lack of composition data
457	Sludges with organic residues	Includes some halogenated components
510	Flue-gas scrubber liquid	
511	Rinse water and waste water	Contains small units of oil, solvent, metals and/or mud; also bilge water
514	Contaminated oil and sand	
515	Drilling mud	
519	Fly ash and retort ash	Combustion-generated particulates mineral matter plus some carbon

UCD CODE	DESCRIPTION	TYPICAL WASTES
524	Chemical toilet wastes	
525	Metal dust and machining wastes	Primarily ferrous and aluminum-based alloys
526	Cannery wastes	
527	Mud/sediment and water	
530	Contaminated pallets	
533	Contaminated equipment and containers	Contaminants not stated
535	Totally unspecified wastes	Used only for California manifest purposes

APPENDIX B

APPENDIX B
Consolidated UCD Classification

SOURCE: Proctor and Redfern et. al. (1982)

	DESCRIPTION OF WASTE STREAM	PHYSICAL CHARACTERISTICS	CHEMICAL CHARACTERISTICS	UCD CODES	TREATMENT OPTIONS	RESOURCE RECOVERY	DISPOSAL OPTIONS
1	ORGANIC SLUDGES AND STILL BOTTOMS (NO OIL) Organic sludges containing metals Halogenated still bottoms Non-Halogenated still bottoms	Viscous or Thixotropic when dewatered	Generally burnable except ash may contain metals. Heating value is net positive, but may require drying or special air pollution control for combustion	247, 248, 252, 261, 263, 446, 523, 529, 257	Incineration Landfarm		Fixation or Solidification Prior to secure landfill
2	SOLVENTS & ORGANIC SOLUTIONS Halogenated Non-Halogenated Mixed	Liquid with some solid contaminants	Reasonably flammable. High heating value. Halogenated vapours may be corrosive	211, 212, 213, 214, 215, 216, 217, 221, 222, 223, 224	Incineration	Distillation Blending	
3	OILS AND GREASES Waste Lube Oil Other Oils and Grease	Dirty lube oils, cutting oils, hydraulic oils. Most contain contaminants.	High heating value. Generally neutral pH	281	Physical/ Chemical Incineration	Distillation	Land Farming
4	OIL/WATER MIXTURES Emulsified and Free Oil/Water Mixtures	Liquid with separate or dispersed phases. May become viscous at low temperatures	Generally neutral, low pH may result from emulsion breaking. Usually no positive heating value before separation	283	Physical/ Chemical Incineration	Blending or Distillation	Land Farming
5	ORGANIC AND OILY RESIDUES Leaded Gasoline Unleaded Gasoline and Organics Food Waste Oil	Thick multi-phase material. Most have inorganics in with organics. May be thick or thixotropic	Partly combustible. pH may be variable. Could be volatile or odourous. May be explosive in confined containers	264, 282, 284, 285, 286, 288, 289, 447	Incineration	Lead may be recovered. Reuse or Distillation	Land Farming Secure Landfill or solidification prior to secure landfill
6	HEAVY METAL SOLUTIONS AND RESIDUALS Spent plating or etching Rinse and less concentrated aqueous solutions Sludges from plating and etching lines Sludges from treatment of solutions containing metals	Acid or alkaline liquids, frequently with solids in solution. Sometimes difficult to pump, physical dewatering required. Reclamation difficult because of stable precipitates.	Extreme pH swings. Complexation is prevalent, special pretreatment is usually needed Stable chemical precipitates. Highly complexed ammonia, sulfide and/or cyanide species	111, 112, 113, 121, 122, 123, 131, 132, 133, 141, 142, 143, 244, 251, 431, 433, 445, 523	Physical/ Chemical	Ion exchange	Fixation or encapsulation Secure Landfill or solidification

	DESCRIPTION OF WASTE STREAMS	PHYSICAL CHARACTERISTICS	CHEMICAL CHARACTERISTICS	UCD CODES	TREATMENT OPTIONS	RESOURCE RECOVERY	DISPOSAL OPTIONS
7	MISCELLANEOUS CHEMICALS AND PRODUCTS Organic Chemicals Inorganic Chemicals Salts, Infectious	Properties variable. Some solids and liquids Containers found in all sizes including small laboratory sizes	Entire spectrum of products and properties	145, 152, 243, 245, 416, 513, 161, 528	Incineration	Possible but no general technology	Must be packed for disposal at secure landfill
8	PAINT AND ORGANIC RESIDUALS Latex paint and sludge Solvent based Paint and sludge Wash and Rinse waters Adhesives and Glue	Thick sludge consists of aged paint and heels from drums. Highly viscous.	Mixtures may contain solvents. Also some chromium, zinc, lead found in pigments.	254, 258, 262, 454, 455	Incineration	Metal recovery from ash possible	Ash may require fixation prior to secure landfill
9	AQUEOUS SOLUTIONS WITH ORGANICS (90% Water) Alcohols and Organic Acids Halogenated Solvents Non_Halogenated Solvents	May have volatile components. Sometimes particulate contaminants are present.	Largely neutral wastes with residual organics. May be azeotropic in nature	225, 226, 227, 228	Biological	Steam stripping or distillation	To Sewer
10	ANION COMPLEXES Cyanide Sulfide Other Complexes	High TDS material which can be corrosive or erosive.	Found in combination with metals or high salt solutions. pH is neutral to alkaline	146, 147, 444	Physical/ Chemical Biological	Conversion (experimental)	Solidification Landfill
11	SLUDGES AND INORGANIC RESIDUALS Ash Spent Catalyst	Most are solids with small amount or water. Most are not reactive. Some low rate leaching expected for arsenic, cadmium, acid, etc.	Chemically inert except for residual ion concentrations. Leachates may be either acid or alkaline	151, 165, 167, 417, 441, 443, 518, 509	Solidification or fixation prior to secure landfill		Sanitary Landfill
12	PESTICIDE AND HERBICIDE WASTES High Concentration Organics High Concentration with metals Cleanup waster and dilute solutions	Liquids or solids. Solids are likely to be present with inorganic Carrier	Reactive compounds. Some halogens present. Some reactive non-metals	241, 532	Biological Incineration	Little potential presently	

	DESCRIPTION OF WASTE STREAMS	PHYSICAL CHARACTERISTICS	CHEMICAL CHARACTERISTICS	UCD CODES	TREATMENT OPTIONS	RESOURCE RECOVERY	DISPOSAL OPTIONS
13	PCB WASTES High concentration Liquids (>500 ppm) Medium concentration Liquids (<500 ppm) Contaminated Soil (<50 ppm)	High strength wastes are mostly liquids. Medium strength may be flushing liquids or soil or metals in contact with high strength	Unreactive except for high chloride content. Volatility is low but lighter aroclor's are volatile	242	Liquid Incineration or salt conversion to inorganic salts		
14	CLEAN-UP RESIDUALS Solvent and Organic Waste Inorganic and Metals Pesticides and Herbicides	Cleanup materials are largely soil contaminated or wastes absorbed onto some solid matrix	Chemical composition depends upon nature of spill	512, 521, 528, 531, 532		Possible in some cases through distillation or liquid/liquid extraction	Most are directly buried in Sanitary Land fill Secure Landfill

APPENDIX C

APPENDIX C
Two Digit U.S. SIC Classification Major Groups

Major Group	Description
Division A. Agriculture, forestry and fishing	
01	Agricultural production - crops
02	Agricultural production - livestock
07	Agricultural services
08	Forestry
09	Fishing, hunting, and trapping
Division B. Mining	
10	Metal mining
11	Anthracite mining
12	Bituminous coal and lignite mining
13	Oil and gas extraction
14	Mining and quarrying of nonmetallic minerals, except fuels
Division C. Construction	
15	Building construction - general contractors and operative builders
16	Construction other than building construction - general contractors
17	Construction - special trade contractors
Division D. Manufacturing	
20	Food and kindred products
21	Tobacco manufactures
22	Textile mill products
23	Apparel and other finished products made from fabrics and similar materials
24	Lumber and wood products, except furniture
25	Furniture and fixtures
26	Paper and allied products
27	Printing, publishing, and allied industries
28	Chemicals and allied products
29	Petroleum refining and related industries

Major Group	Description
Division D. Manufacturing ... continued	
30	Rubber and miscellaneous plastics products
31	Leather and leather products
32	Stone, clay, glass, and concrete products
33	Primary metal industries
34	Fabricated metal products, except machinery and transportation equipment
35	Machinery, except electrical
36	Electrical and electronic machinery, equipment, and supplies
37	Transportation equipment
38	Measuring, analyzing, and controlling instruments photographic, medical and optical goods; watches and clocks
39	Miscellaneous manufacturing industries
Division E. Transportation, communications, electric, gas, and sanitary services	
40	Railroad transportation
41	Local and suburban transit and interurban highway passenger transportation
42	Motor freight transportation and warehousing
43	Postal Service
44	Water transportation
45	Transportation by air
46	Pipe lines, except natural gas
47	Transportation services
48	Communication
49	Electric, gas, and sanitary services
Division F. Wholesale trade	
50	Wholesale trade - durable goods
51	Wholesale trade - nondurable goods
Division G. Retail trade	
52	Building materials, hardware, garden supply, and mobile home dealers
53	General merchandise stores
54	Food stores
55	Automotive dealers and gasoline service stations
56	Apparel and accessory stores
57	Furniture, home furnishings, and equipment stores
58	Eating and drinking places
59	Miscellaneous retail

Major Group	Description
Division H. Finance, insurance, and real estate	
60	Banking
61	Credit agencies other banks
62	Security and commodity brokers, dealers, exchanges, and services
63	Insurance
64	Insurance agents, brokers, and service
65	Real estate
66	Combinations of real estate, insurance, loans, law offices
67	Holding and other investment offices
Division I. Services	
70	Hotels, rooming houses, camps, and other lodging places
72	Personal services
73	Business services
75	Automotive repair, services, and garages
76	Miscellaneous repair services
78	Motion pictures
79	Amusement and recreation services, except motion pictures
80	Health services
81	Legal services
82	Educational services
83	Social services
84	Museums, art galleries, botanical and zoological gardens
86	Membership organizations
88	Private households
89	Miscellaneous services
Division J. Public administration	
91	Executive, legislative, and general government, except finance
92	Justice, public order, and safety
93	Public finance, taxation, and monetary policy
94	Administration of human resources programs
95	Administration of environmental quality and housing programs
96	Administration of economic programs
97	National security and international affairs
Division K. Nonclassifiable establishments	
99	Nonclassifiable establishments

APPENDIX D

APPENDIX D

Sample Forms Employed in Survey

Attached are samples of Letters and Questionnaire Forms employed in the survey:

- Questionnaire Cover Letter
- Questionnaires
  - Manufacturing
  - Non-Manufacturing
  - Institution
- Follow-up Letter
- Second Follow-up Letter to Minor Generators

WARDROP
ENGINEERING INC.

PRINCIPALS
L.R. McGinnis, B.Sc., M.Sc., P.Eng.
D.R. Grimes, B.Eng., M.Sc., P.Eng.
B.C. Walker, B.Sc., P.Eng.
S. Dominon, B.Sc., P.Eng.
W.D. Christie, B.Sc., P.Eng.
E.C. Card, B.Sc., M.Sc., P.Eng.
J.S. Paulsen, B.Sc., P.Eng.
G.G. Zacharias, C.M.A.
J.L. Greer, B.Sc., P.Eng.

ASSOCIATES
J.D. Chale, C.E.T.
R.E. Derksen, B.Sc., P.Eng.
J. Dubslaw
W.R. Dowhopolsh, C.E.T.
L.R. Ferchoff, B.Sc., P.Eng.
R.R. Foster, B.A., B.Sc., MCP, P.Eng.
R.K. Gierche, B.Sc., P.Eng.
B.W. Gulay, B.Sc., P.Eng.
G.S. Holmes, C.E.T.
H. Husain, B.Sc., M.Sc., Ph.D., P.Eng.

ASSOCIATES
D.M. Kawa, B.Sc., M.Sc., P.Eng.
G.J. Maguet, B.Sc., M.Sc., P.Eng.
J.P. Parry, B.A.P.Sc., M.Sc., MBA, P.Eng.
L.E. Pond, B.A.Sc., P.Eng.
G.W. Regier, C.E.T.
D.H. Robbins, B.Sc., P.Eng.
L.W. Stone
H.O. Weckert, B.A.Sc., M.A.Sc., P.Eng.
V.H. Wiens, B.Sc., P.Eng.
L.C. Secord, B.Sc., P.Eng.

Questionnaire Cover Letter

Dear Sir or Madam:

As mentioned in the letter issued to you previously by the Manitoba Hazardous Waste Management Corporation, Wardrop Engineering Inc., with the assistance of the University of Manitoba Research Ltd., is conducting a study to characterize the provincial hazardous waste market. In an attempt to accurately determine the quantity and nature of hazardous wastes generated within the Province, we anticipate contacting over 700 manufacturing companies, service companies, and institutions across the Province.

The enclosed questionnaire is divided into two sections. The first part is the Respondent Data Section, which requests pertinent information about your establishment. The second part of the questionnaire is the Hazardous Waste Data Report. We request that you fill out one separate report form for EACH hazardous waste stream at EACH generation location. For some establishments, this may entail filling out several forms. We have included two Hazardous Waste Data Report forms for your convenience. If more are necessary, please either photocopy the form, or contact us and we will forward additional forms. We anticipate, based on an earlier pretest of the questionnaire, that it will require about 20 minutes to complete the forms. We have also enclosed a stamped, self-addressed envelope for you to return the questionnaire.

Establishments contacted during the survey are identified on questionnaire forms only by a coded number. We stress that your submission will be considered confidential, and will be used solely by the Corporation for the planning and development of a comprehensive hazardous waste management system to service Manitoba waste generators.

Your timely response is vital to the success of the study. If you have any questions, do not hesitate to contact me. I would like to express my thanks for your cooperation with our efforts.

Yours truly,
WARDROP ENGINEERING INC.

Robert V. Parsons, P.Eng.
Telephone 956 - 0980, Fax 957 - 5389

HAZARDOUS WASTE GENERATION QUESTIONNAIRE

(Questionnaire for Manufacturing Companies)

ID CODE NUMBER:

INSTRUCTIONS

- Fill in the general information requested in the Respondent Data section.
- Complete a Hazardous Waste Data Report for EACH hazardous waste stream at EACH generation location. Duplicate the form if necessary, or contact us for additional forms if required.
- Please answer each question, or check the applicable box(es). If NO response is applicable, mark N/A.
- For your information, a reference sheet is included on the back of this form, which describes hazardous wastes.
- Also include hazardous wastes that are treated on-site or recycled.

RESPONDENT DATA

1. Person completing this form _____

   Title _____

   Telephone number _____

   Number of Hazardous Waste Data Reports completed _____

2. What is your establishment's primary activity?

   _____

3. How many employees do you have ?

   Total _____

   Plant* Staff _____

   * Not involved in Administration, Marketing, Clerical, etc.

4. What is your approximate yearly production output? (if can provide)

   _____ _____ (units)/year

5. Is the hazardous waste generated at the same location as the company mailing address?

   [] Yes
   [] No If No, please specify location(s):

WHAT ARE HAZARDOUS WASTES?

Hazardous Wastes are materials that are harmful to the environment and, in some cases, to human health, when disposed of in a random or uncontrolled manner.

Hazardous Characteristics can include:

- flammability
- corrosiveness
- chemical reactivity
- infectiousness
- toxicity - causing an immediate and/or irreversible threat to life, or damage to humans, other animals, plants, or the environment.

Hazardous Wastes in Manitoba are now governed by Provincial Regulations, and by the Dangerous Goods Handling and Transportation Act.

Common examples of Hazardous Wastes include the following:

caustic solution
acid solution
waste oils
waste inks
photographic chemicals
plating waste
pickling waste
used or contaminated solvents
reactive metals
waste/used antifreeze
pesticides
cyanide
mercury
phenols
pathological wastes
dissolved metals
pigment metals
waste chemicals
residues and sludges

A Hazardous Waste Stream is all hazardous wastes from a single location that are mixed and disposed together. Examples of a Waste Stream include:

- waste solvents collected together in a drum.
- waste acid solution neutralized and discharged to sewer.

Halogenated Organic compounds contain chlorine, fluorine or bromine, and include such compounds as perchloroethylene, chloroform, freon, and carbon tetrachloride.

Heavy Metals include antimony, arsenic, barium, beryllium, boron, cadmium, copper, indium, lead, manganese, mercury, molybdenum, nickel, selenium, silver, tin, vanadium, and zinc.

Wastes NOT included in this survey are:

- explosives
- radioactive materials
- non-hazardous wastes normally acceptable to regulatory agencies
- accidental spills (or emergencies)

I.D. Code Number:

HAZARDOUS WASTE DATA REPORT

Fill out one separate form for EACH hazardous waste stream generated at EACH location.

- Hazardous Waste Data Report for Manufacturing Companies
- Duplicate if necessary

1. Please describe this hazardous waste stream in your own words:

2. Hazardous Waste Name:

3. At what location is this hazardous waste stream generated? (i.e. name of city, town or municipality)

_____

4. Physical form:

[] Gas
[] Light Liquid
[] Heavy Liquid
[] Sludge
[] Thick Sludge
[] Solid

5. Is it:

[] Oil Based
[] Water Based

IN ORDER TO PROPERLY CLASSIFY THIS HAZARDOUS WASTE STREAM, PLEASE ANSWER THE FOLLOWING SERIES OF QUESTIONS:

6. Does this hazardous waste stream contain ANY of the following? (Refer to the reference sheet if necessary, and check ALL appropriate boxes)

[] Halogenated organic compounds
[] Any other organic compounds
[] Heavy metals
[] Any other metals
[] Cyanides
[] None

7. Does this hazardous waste stream fall under any of the following categories?

[] Acid Solution ..... pH_____
[] Alkaline Solution ..... pH_____
[] Metal Finishing Solution
[] Other Aqueous (Salt) Solution
[] Inorganic Solids
[] Fertilizer
[] Contaminated Soil
[] Spent Solvent
[] Waste Oil or Grease
[] Oil/Water Mixture
[] Pigment, Paint, or Ink Residues
[] Plastics or Resins
[] Pathological or Biological Waste
[] Pharmaceuticals
[] Pesticide or Herbicide
[] PCB
[] Organic Solid

8. Please provide more detail on the composition of this hazardous waste stream, if known:

List known principle constituents	Approximate % weight [] or mg/L [] (if known)
1._____	_____
2._____	_____
3._____	_____
4._____	_____
5._____	_____

If more constituents are known, list on the back of the form.

QUANTITY OF THE HAZARDOUS WASTE STREAM GENERATED:

9. Current average quantity of this hazardous waste stream generated:

_____ [] kg/month
[] L/month
[] Other units, please specify _____

10. Is there seasonal variation?

[] No
[] Yes If Yes,

_____ is the Minimum month , _____% of average flow

_____ is the Maximum month , _____% of average flow

11. Estimated future volume in 2 years:

[] No Change
[] Increase by _____%
[] Decrease by _____%

12. Please describe the process or other operation which generates this hazardous waste stream:

13. If possible please describe your process using a simplified block schematic diagram, and indicate where this waste stream originates (use the back of the form if necessary):

14. Do you foresee any technical changes in your process, product mix, or technology that would result in a major reduction of this hazardous waste within the next 5 years?

[] No
[] Yes If Yes, please describe what these changes would be, and what waste reduction you would foresee _____ %

PRESENT METHOD OF DEALING WITH THIS HAZARDOUS WASTE STREAM

15. Do you provide storage for this hazardous waste stream prior to on-site or off-site disposal?

[] No
[] Yes If Yes, Type and capacity of container _____

Length of storage time _____

16. Do you dispose of this hazardous waste stream [] On-site, or
[] Off-site

17. If on-site, which of the following do you employ?

[] Recycle, Recovery, Reduction, or Reuse.
[] Incineration or use as fuel.
[] Discharge to municipal sewer.
[] Surface discharge to land.
[] Discharge to water course.
[] Discharge to pit or landfill.
[] Evaporation.
[] On-site treatment, please describe method:

[] Other, please describe:

18. If off-site, do you:

[] Remove this waste yourself
[] Employ municipal or conventional solid waste service
[] Employ a commercial haulage or treatment service
[] Other, please specify:

18. ... (Cont)

Frequency of waste removal:

[] Continuous as produced
[] Discrete loads:

_____ Times Daily/Weekly/Monthly

Quantity per load _____

Method of removal:

[] Drum
[] Bucket
[] Tank Truck
[] Tank Rail Car
[] Other (specify)_____

Ultimate Destination of the Waste:

[] Within the Province
[] Outside the Province
[] Outside the Country

Do you know the exact ultimate location? If so, please specify:

What is the method of treatment, recycling or disposal employed at that location (if known)?

ADDITIONAL SPACE FOR COMMENTS OR DESCRIPTIONS:

HAZARDOUS WASTE GENERATION QUESTIONNAIRE

(Questionnaire for Non-Manufacturing Companies)

ID CODE NUMBER:

INSTRUCTIONS

- Fill in the general information requested in the Respondent Data section.
- Complete a Hazardous Waste Data Report for EACH hazardous waste stream at EACH generation location. Duplicate the form if necessary, or contact us for additional forms if required.
- Please answer each question, or check the applicable box(es). If NO response is applicable, mark N/A.
- For your information, a reference sheet is included on the back of this form, which describes hazardous wastes.
- Also include hazardous wastes that are treated on-site or recycled.

RESPONDENT DATA

1. Person completing this form _____

   Title _____

   Telephone number _____

   Number of Hazardous Waste Data Reports completed _____

2. What is your establishment's primary activity?

   _____

3. How many employees do you have ?

   Total _____

   Plant* Staff _____

   * Not involved in Administration, Marketing, Clerical, etc.

4. Is the hazardous waste generated at the same location as the company mailing address?

   [] Yes
   [] No If No, please specify location(s):

WHAT ARE HAZARDOUS WASTES?

Hazardous Wastes are materials which are harmful to the environment and, in some cases, human health, when disposed of in a random or uncontrolled manner.

Hazardous Characteristics can include:

- flammability
- corrosiveness
- chemical reactivity
- infectiousness
- toxicity - causing an immediate and/or irreversible threat to life, or damage to humans, other animals, plants, or the environment.

Hazardous Wastes in Manitoba are now governed by Provincial Regulations, and by the Dangerous Goods Handling and Transportation Act.

Common examples of Hazardous Wastes include the following:

caustic solution
acid solution
waste oils
waste inks
photographic chemicals
plating waste
pickling waste
used or contaminated solvents
reactive metals
waste/used antifreeze
pesticides
cyanide
mercury
phenols
pathological wastes
dissolved metals
pigment metals
waste chemicals
residues and sludges

A Hazardous Waste Stream is all hazardous wastes from a single location that are mixed and disposed together. Examples of a Waste Stream include:

- waste solvents collected together in a drum.
- waste acid solution neutralized and discharged to sewer.

Halogenated Organic compounds contain chlorine, fluorine or bromine, and include such compounds as perchloroethylene, chloroform, freon, and carbon tetrachloride.

Heavy Metals include antimony, arsenic, barium, beryllium, boron, cadmium, copper, indium, lead, manganese, mercury, molybdenum, nickel, selenium, silver, tin, vanadium, and zinc.

Wastes NOT included in this survey are:

- explosives
- radioactive materials
- non-hazardous wastes normally acceptable to regulatory agencies
- accidental spills (or emergencies)

I.D. Code Number:

HAZARDOUS WASTE DATA REPORT

Fill out one separate form for EACH hazardous waste stream generated at EACH location.

- Hazardous Waste Data Report for Non-Manufacturing Companies
- Duplicate if necessary

1. Please describe this hazardous waste stream in your own words:

2. Hazardous Waste Name:

3. At what location is this hazardous waste stream generated? (i.e. name of city, town or municipality)

_____

4. Physical form:

[] Gas
[] Light Liquid
[] Heavy Liquid
[] Sludge
[] Thick Sludge
[] Solid

5. Is it:

[] Oil Based
[] Water Based

IN ORDER TO PROPERLY CLASSIFY THIS HAZARDOUS WASTE STREAM, PLEASE ANSWER THE FOLLOWING SERIES OF QUESTIONS:

6. Does this hazardous waste stream contain ANY of the following? (Refer to the reference sheet if necessary, and check ALL appropriate boxes)

[] Halogenated organic compounds
[] Any other organic compounds
[] Heavy metals
[] Any other metals
[] Cyanides
[] None

7. Does this hazardous waste stream fall under any of the following categories?

[] Acid Solution ..... pH_____
[] Alkaline Solution ..... pH_____
[] Metal Finishing Solution
[] Other Aqueous (Salt) Solution
[] Inorganic Solids
[] Fertilizer
[] Contaminated Soil
[] Spent Solvent
[] Waste Oil or Grease
[] Oil/Water Mixture
[] Pigment, Paint, or Ink Residues
[] Plastics or Resins
[] Pathological or Biological Waste
[] Pharmaceuticals
[] Pesticide or Herbicide
[] PCB
[] Organic Solid

8. Please provide more detail on the composition of this hazardous waste stream, if known:

List known principle constituents	Approximate % weight [] or mg/L [] (if known)
1._____	_____
2._____	_____
3._____	_____
4._____	_____
5._____	_____

If more constituents are known, list on the back of the form.

QUANTITY OF THE HAZARDOUS WASTE STREAM GENERATED:

9. Current average quantity of this hazardous waste stream generated:

_____ [] kg/month
[] L/month
[] Other units, please specify _____

10. Is there seasonal variation?

[] No
[] Yes If Yes,

_____ is the Minimum month , _____% of average flow

_____ is the Maximum month , _____% of average flow

11. Estimated future volume in 2 years:

[] No Change
[] Increase by _____%
[] Decrease by _____%

12. Please describe the process or other operation which generates this hazardous waste stream:

13. Do you foresee any technical changes in your process, product mix, or technology that would result in a major reduction of this hazardous waste within the next 5 years?

[] No
[] Yes If Yes, please describe what these changes would be, and what waste reduction you would foresee _____ %

PRESENT METHOD OF DEALING WITH THIS HAZARDOUS WASTE STREAM

14. Do you provide storage for this hazardous waste stream prior to on-site or off-site disposal?

[] No
[] Yes If Yes, Type and capacity of container _____

Length of storage time _____

15. Do you dispose of this hazardous waste stream [] On-site, or
[] Off-site

16. If on-site, which of the following do you employ?

[] Recycle, Recovery, Reduction, or Reuse.
[] Incineration or use as fuel.
[] Discharge to municipal sewer.
[] Surface discharge to land.
[] Discharge to water course.
[] Discharge to pit or landfill.
[] Evaporation.
[] On-site treatment, please describe method:

[] Other, please describe:

17. If off-site, do you:

[] Remove this waste yourself
[] Employ municipal or conventional solid waste service
[] Employ a commercial haulage or treatment service
[] Other, please specify:

17. ... (Cont)

Frequency of waste removal:

[] Continuous as produced
[] Discrete loads:

_____ Times Daily/Weekly/Monthly

Quantity per load _____

Method of removal:

[] Drum
[] Bucket
[] Tank Truck
[] Tank Rail Car
[] Other (specify)_____

Ultimate Destination of the Waste:

[] Within the Province
[] Outside the Province
[] Outside the Country

Do you know the exact ultimate location? If so, please specify:

What is the method of treatment, recycling or disposal employed at that location (if known)?

ADDITIONAL SPACE FOR COMMENTS OR DESCRIPTIONS:

HAZARDOUS WASTE GENERATION QUESTIONNAIRE

(Questionnaire for Institutions)

ID CODE NUMBER:

INSTRUCTIONS

- Fill in the general information requested in the Respondent Data section.
- Complete a Hazardous Waste Data Report for EACH hazardous waste stream at EACH generation location. Duplicate the form if necessary, or contact us for additional forms if required.
- Please answer each question, or check the applicable box(es). If NO response is applicable, mark N/A.
- For your information, a reference sheet is included on the back of this form, which describes hazardous wastes.
- Also include hazardous wastes that are treated on-site or recycled.

RESPONDENT DATA

1. Person completing this form _____

   Title _____

   Telephone number _____

   Number of Hazardous Waste Data Reports completed _____

2. What is your establishment's primary activity?

   _____

3. How many employees do you have ?

   Total _____

   Non-Administrative Staff _____

4. Do you have a policy in place to deal with hazardous wastes?

   [] Yes
   [] No

5. Is the hazardous waste generated at the same location as the institution mailing address?

   [] Yes
   [] No

WHAT ARE HAZARDOUS WASTES?

Hazardous Wastes are materials which are harmful to the environment and, in some cases, to human health, when disposed of in a random or uncontrolled manner.

Hazardous Characteristics can include:

- flammability
- corrosiveness
- chemical reactivity
- infectiousness
- toxicity - causing an immediate and/or irreversible threat to life, or damage to humans, other animals, plants, or the environment.

Hazardous Wastes in Manitoba are now governed by Provincial Regulations, and by the Dangerous Goods Handling and Transportation Act.

Common examples of Hazardous Wastes include the following:

caustic solution
acid solution
waste oils
waste inks
photographic chemicals
plating waste
pickling waste
used or contaminated solvents
reactive metals
waste/used antifreeze
pesticides
cyanide
mercury
phenols
pathological wastes
dissolved metals
pigment metals
waste chemicals
residues and sludges

A Hazardous Waste Stream is all hazardous wastes from a single location that are mixed and disposed together. Examples of a Waste Stream include:

- waste solvents collected together in a drum.
- waste acid solution neutralized and discharged to sewer.

Halogenated Organic compounds contain chlorine, fluorine or bromine, and include such compounds as perchloroethylene, chloroform, freon, and carbon tetrachloride.

Heavy Metals include antimony, arsenic, barium, beryllium, boron, cadmium, copper, indium, lead, manganese, mercury, molybdenum, nickel, selenium, silver, tin, vanadium, and zinc.

Wastes NOT included in this survey are:

- explosives
- radioactive materials
- non-hazardous wastes normally acceptable to regulatory agencies
- accidental spills (or emergencies)

I.D. Code Number:

HAZARDOUS WASTE DATA REPORT

Fill out one separate form for EACH hazardous waste stream generated at EACH location.

- Hazardous Waste Data Report for Institutions
- Duplicate if necessary

1. Please describe this hazardous waste stream in your own words:

2. Hazardous Waste Name:

3. At what location is this hazardous waste stream generated? (i.e. name of city, town or municipality)

_____

4. Physical form:

- [] Gas
- [] Light Liquid
- [] Heavy Liquid
- [] Sludge
- [] Thick Sludge
- [] Solid

5. Is it:

- [] Oil Based
- [] Water Based

IN ORDER TO PROPERLY CLASSIFY THIS HAZARDOUS WASTE STREAM, PLEASE ANSWER THE FOLLOWING SERIES OF QUESTIONS:

6. Does this hazardous waste stream contain ANY of the following? (Refer to the reference sheet if necessary, and check ALL appropriate boxes)

- [] Halogenated organic compounds
- [] Any other organic compounds
- [] Heavy metals
- [] Any other metals
- [] Cyanides
- [] None

7. Does this hazardous waste stream fall under any of the following categories?

- [] Acid Solution ..... pH_____
- [] Alkaline Solution ..... pH_____
- [] Metal Finishing Solution
- [] Other Aqueous (Salt) Solution
- [] Inorganic Solids
- [] Fertilizer
- [] Contaminated Soil
- [] Spent Solvent
- [] Waste Oil or Grease
- [] Oil/Water Mixture
- [] Pigment, Paint, or Ink Residues
- [] Plastics or Resins
- [] Pathological or Biological Waste
- [] Pharmaceuticals
- [] Pesticide or Herbicide
- [] PCB
- [] Organic Solid

8. Please provide more detail on the composition of this hazardous waste stream, if known:

List known principle constituents	Approximate % weight [] or mg/L [] (if known)
1._____	_____
2._____	_____
3._____	_____
4._____	_____
5._____	_____

If more constituents are known, list on the back of the form.

QUANTITY OF THE HAZARDOUS WASTE STREAM GENERATED:

9. Current average quantity of this hazardous waste stream generated:

_____ [] kg/month
[] L/month
[] Other units, please specify _____

10. Is there seasonal variation?

[] No
[] Yes If Yes,

_____ is the Minimum month , _____% of average flow

_____ is the Maximum month , _____% of average flow

11. Estimated future volume in 2 years:

[] No Change
[] Increase by _____%
[] Decrease by _____%

12. Please describe the process or other operation which generates this hazardous waste stream:

13. Do you foresee any technical changes in the operation of your institution that would result in a major reduction of this hazardous waste within the next 5 years?

[] No
[] Yes If Yes, please describe what these changes would be, and what waste reduction you would foresee _____ %

PRESENT METHOD OF DEALING WITH THIS HAZARDOUS WASTE STREAM

14. Do you provide storage for this hazardous waste stream prior to on-site or off-site disposal?

[] No
[] Yes If Yes, Type and capacity of container _____

Length of storage time _____

15. Do you dispose of this hazardous waste stream [] On-site, or
[] Off-site

16. If on-site, which of the following do you employ?

[] Recycle, Recovery, Reduction, or Reuse.
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[] Discharge to municipal sewer.
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[] Discharge to water course.
[] Discharge to pit or landfill.
[] Evaporation.
[] On-site treatment, please describe method:

[] Other, please describe:

17. If off-site, do you:

[] Remove this waste yourself
[] Employ municipal or conventional solid waste service
[] Employ a commercial haulage or treatment service
[] Other, please specify:

17. ... (Cont)

Frequency of waste removal:

[] Continuous as produced
[] Discrete loads:

_____ Times Daily/Weekly/Monthly

Quantity per load _____

Method of removal:

[] Drum
[] Bucket
[] Tank Truck
[] Tank Rail Car
[] Other (specify)_____

Ultimate Destination of the Waste:

[] Within the Province
[] Outside the Province
[] Outside the Country

Do you know the exact ultimate location? If so, please specify:

What is the method of treatment, recycling or disposal employed at that location (if known)?

ADDITIONAL SPACE FOR COMMENTS OR DESCRIPTIONS:

WARDROP
ENGINEERING INC.

PRINCIPALS
L.R. McGinnis, B.Sc., M.Sc., P.Eng
D.R. Grimes, B.Eng., M.Sc., P.Eng.
B.C. Walker, B.Sc., P.Eng.
S. Denison, B.Sc., P.Eng.
W.D. Christie, B.Sc., P.Eng.
E.C. Card, B.Sc., M.Sc., P.Eng.
J.S. Paulsen, B.Sc., P.Eng
G.G. Zacharias, C.M.A.
J.L. Greer, B.Sc., P.Eng

ASSOCIATES
J.D. Chale, C.E.T.
R.E. Derksen, B.Sc., P.Eng
J. Dobelaar
W.R. Dewhopolak, C.E.T.
L.R. Ferchaft, B.Sc., P.Eng
R.R. Foster, B.A., B.Sc., MCP, P.Eng
B.K. Gierche, B.Sc., P.Eng
B.W. Gulay, B.Sc., P.Eng
G.S. Holmes, C.E.T.
H. Husain, B.Sc., M.Sc., Ph.D., P.Eng

ASSOCIATES
D.M. Kawa, B.Sc., M.Sc., P.Eng
G.J. Maguet, B.Sc., M.Sc., P.Eng
J.P. Parry, B.A.P.Sc., M.Sc., MBA, P.Eng
L.E. Pond, B.A.Sc., P.Eng
G.W. Reger, C.E.T.
D.H. Robbins, B.Sc., P.Eng
L.W. Stone
H.O. Weickert, B.A.Sc., M.A.Sc., P.Eng
V.H. Wiens, B.Sc., P.Eng
L.C. Secord, B.Sc., P.Eng

Follow-up Letter to All Non-respondents

Dear Sir or Madam:

You recently received a survey questionnaire relating to a hazardous waste market characterization study which we are conducting on behalf of the Manitoba Hazardous Waste Management Corporation.

In order to develop an efficient and cost-effective system, capable of servicing Manitoba's hazardous waste generators, it is imperative that an accurate market characterization be developed.

It is in this context that we urge you to complete and return the questionnaire to us as soon as possible. If you have encountered any problems, or if you did not receive the questionnaire, please contact me directly and I will provide whatever assistance may be required to achieve our objective.

If you have already completed and returned the forms, I thank you for your cooperation.

Yours truly,
WARDROP ENGINEERING INC.

Robert V. Parsons, P.Eng.
Telephone 956 - 0980, Fax 957 - 5389

WARDROP ENGINEERING INC.

PRINCIPALS
L.R. McGinnis, B.Sc., M.Sc., P.Eng.
D.R. Grimes, B.Eng., M.Sc., P.Eng.
B.C. Walker, B.Sc., P.Eng.
S. Dennison, B.Sc., P.Eng.
W.D. Christie, B.Sc., P.Eng.
E.C. Card, B.Sc., M.Sc., P.Eng.
J.S. Paulsen, B.Sc., P.Eng.
G.G. Zacharias, C.M.A.
J.L. Greer, B.Sc., P.Eng.

ASSOCIATES
J.D. Chale, C.E.T.
R.E. Derksen, B.Sc., P.Eng.
J. Dobelaw
W.R. Dzwiniatsiuk, C.E.T.
L.R. Forchuk, B.Sc., P.Eng.
R.R. Foster, B.A., B.Sc., MCP, P.Eng.
R.K. Gerrits, B.Sc., P.Eng.
B.W. Gulay, B.Sc., P.Eng.
G.S. Holmes, C.E.T.
H. Hussain, B.Sc., M.Sc., Ph.D., P.Eng.

ASSOCIATES
D.M. Kawa, B.Sc., M.Sc., P.Eng.
G.J. Maguet, B.Sc., M.Sc., P.Eng.
J.P. Perry, B.A.P.Sc., M.Sc., MBA, P.Eng.
L.E. Pond, B.A.Sc., P.Eng.
G.W. Repper, C.E.T.
D.H. Robbins, B.Sc., P.Eng.
L.W. Snow
H.O. Werckert, B.A.Sc., M.A.Sc., P.Eng.
V.H. Wiens, B.Sc., P.Eng.
L.C. Seward, B.Sc., P.Eng.

Second Follow-up Letter to Minor Generators

Dear Sir or Madam:

Several weeks ago we forwarded to you a survey questionnaire relating to a hazardous waste market characterization study which we are conducting on behalf of the Manitoba Hazardous Waste Management Corporation.

In order to develop an efficient and cost-effective system, capable of servicing Manitoba's hazardous waste generators, it is imperative that an accurate market characterization be developed. In this regard we urge you to complete and return the questionnaire to us as soon as possible.

We wish to stress the importance of receiving all questionnaires sent out. If you feel your establishment does not generate any hazardous waste materials, please complete and return the form indicating this.

If you have encountered any problems, or if you did not receive the questionnaire, please contact me directly and I will provide whatever assistance may be required.

If you have already completed and returned the forms, I thank you for your cooperation.

Yours truly,
WARDROP ENGINEERING INC.

Robert V. Parsons, P.Eng.
Telephone 956 - 0980, Fax 957 - 5389

APPENDIX E

APPENDIX E

SELECTED WASTE GENERATOR SAMPLE

BY SIC AND TOTAL SIC POPULATION

US SIC		SAMPLE	RESPONSE	D&BTOTAL*
07	Agricultural Services	60	18	127
10	Metal Mining	15	5	16
13	Oil & Gas Extraction	31	5	32
14	Quarrying	17	3	19
20	Food and Kindred	37	12	66
24	Lumber and Wood	4	4	98
25	Furniture	9	4	68
26	Paper and Allied	33	12	33
27	Printing	61	22	168
28	Chemicals	54	35	49
29	Petroleum Refining	7	3	7
30	Rubber and Plastics	44	17	46
31	Leather	19	4	17
32	Stone, Glass and Clay	32	11	73
33	Primary Metals	32	19	33
34	Fabricated Metals	45	26	147
35	Machinery	37	9	158
36	Electrical Machinery	32	15	54
37	Transportation Equipment	33	7	44
40	Railroad Transportation	2	2	6
41	Local Transportation	17	4	41
42	Motor Freight Transport	3	3	478
44	Water Transportation	17	2	17
45	Air Transport	52	12	61
46	Pipelines	2	1	2
48	Communication	1	1	27
49	Utilities	14	9	14
55	Service Stations	100	24	529
72	Personal Services	36	12	99
73	Business Services	80	31	173
75	Auto Garages	107	27	166
76	Repair Services	37	13	17
80	Health Services	29	22	67
82	Educational Services	6	6	63
90	Public Administration	11	9	12
99	Unspecified Industries	217	52	-

* The Dun and Bradstreet list is not complete for some SIC groups.